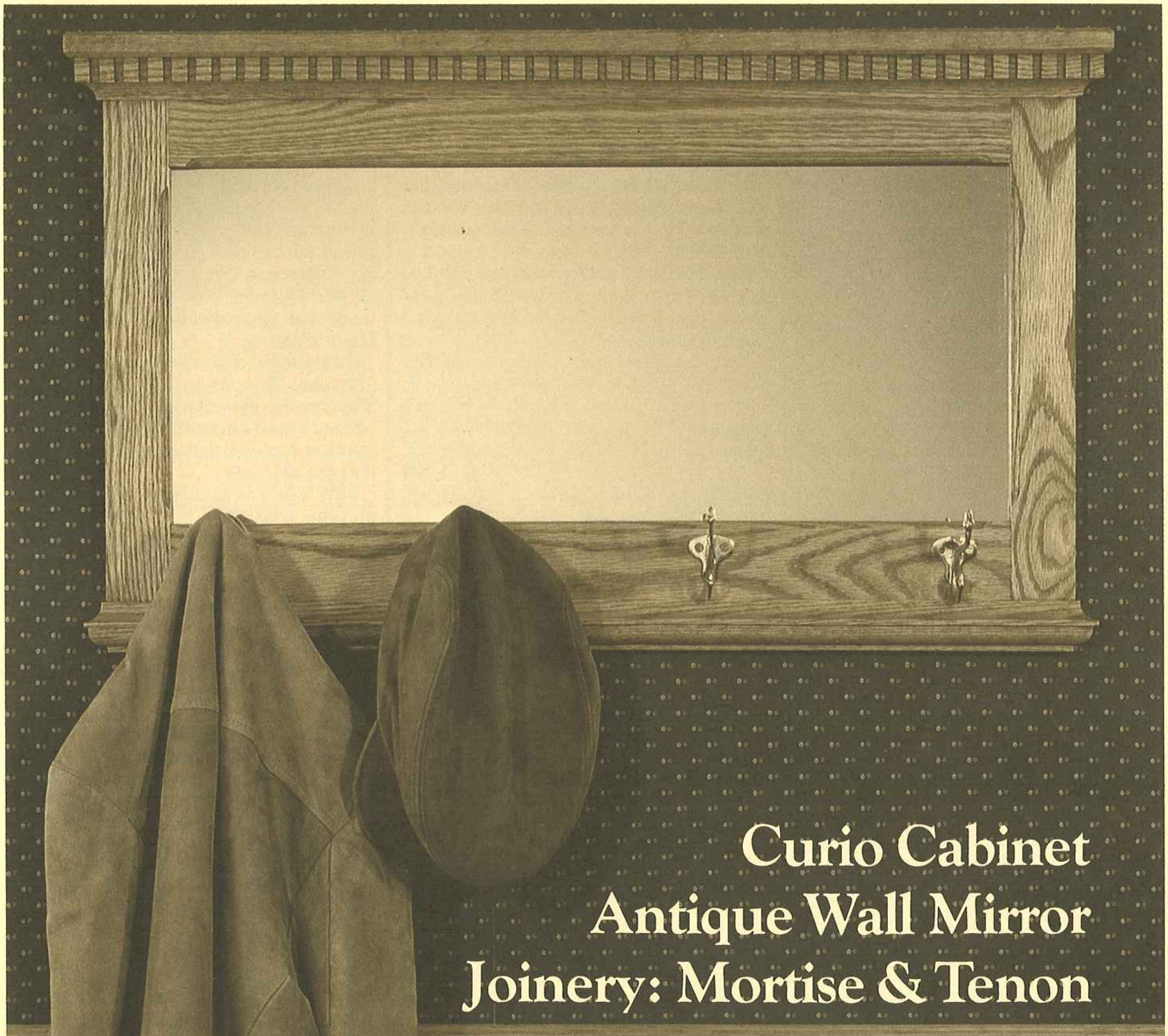
NO. 26 NOTES FROM THE SHOP

Woodsmith®



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Woodsmith®

Number 26 Mar./Apr., 1983

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WOODSMITH® (ISSN 0164-4114) is published bimonthly (January, March, May, July, September, November) by Woodsmith Publishing Co., 2200 Grand Ave., Des Moines, Iowa 50312.
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Sawdust

ABOUT THIS ISSUE. I tend to view cabinetmaking as a series of connected steps; each step important and each leading toward a goal. While the goal might be to build a nice-looking, functional cabinet, completing that goal is not the real reward of woodworking.

To enjoy woodworking you have to enjoy the steps along the way — the process *and* the detail. When the process is completed (and the goal is reached), the reward is simply the satisfaction of knowing the care and patience that it took to make all the details work together.

Okay Don, what's the point of all this wonderful philosophy?

It has to do with the Curio Cabinet in this issue. "It's a handsome cabinet, but I'm not sure I could build it." That was the reaction of the newest addition to our staff, Mike Scott.

But Mike was at a disadvantage. He first saw the curio cabinet when it was completed, and I admit that it tends to look a little intimidating.

I was more fortunate. I saw the building process — all the individual steps I took as I was building the cabinet. When it's broken down into steps like that, it's not intimidating. It's just a lot of work.

The key to most of this work is the joinery, specifically making a mortise and tenon joint. And here again, it's all the details that make the difference. Each joint is like a small project in itself. . . a lot of individual steps that lead to one goal.

Yet once this joint is assembled, no one will ever see it. Only you will know that it fits just right and that it will last a long time . . . secretly doing its job. That's the real reward of woodworking.

ROUTER AND TABLE SAW. If you've been reading *Woodsmith* for a while, you know that the two basic power tools we use are a table saw and router. These two tools, coupled with a drill press (to cut some mortises), are all that's required to build any of the projects in this issue.

That's nice, but what's the point of mentioning it?

It's just that I'm constantly amazed at what you can do with a few basic tools. For example, all of the fancy moldings on the projects in this issue were made with a couple of standard router bits and a router . . . mounted to a router table, of course.

So once again, I'm giving the old sales pitch for building a router table. (It really is helpful to make these moldings.) The plans for our version of a router table appeared in *Woodsmith* No. 20 (and the stand was in No. 22). Or, if you want a six-page plan booklet for the *Woodsmith* router table, contact the *WoodsmithShop* at (800) 444-7002 for more information.

SOURCES. Starting with this issue, we're adding a new regular feature to *Woodsmith:* a "Sources" page. This page is an attempt to give complete information on the tools and hardware needed for the projects in each issue.

As space permits, we'll also use this page to include references to a variety of general source information: mail-order catalogs, books, shows and exhibits; as well as local woodworking clubs and stores that specialize in hardwood.

We'll be dependent on you for some of this information (particularly the clubs and stores in your area). Steve Krohmer has volunteered (that means no increase in pay) to manage all this information.

To start things off, we thought we'd collect information on woodworking clubs around the country. If you belong to a club or guild, and would like other woodworkers in your area to know about it, let Steve know.

NEW FACES. Mike Scott has joined our group to help write and edit the articles in *Woodsmith.* Besides woodworking, his "other love" is music, and he's managed to combine both passions by refinishing several grand pianos.

Mike's first project here was to build the antique wall mirror (featured on the cover). Then I learned another one of his hobbies is photography. So now he's organizing a new photo studio and taking the pictures. (As time goes on, I hope to saddle him with more and more tasks.)

THE MAILING LABEL. We've decided to change the mailing label a little. We used to put the *date* of the last issue in the upper right-hand corner of the label. Starting with this issue, we're putting the *issue number* of the last issue you should receive. This should give a better idea of when your subscription will expire (and when you have to send more money).

NUMBER ONE IS BACK. In addition to the label, we've also changed the protective cover. And in the process we brought old issue No. 1 back to life.

A few months ago I dropped it from the back issue offer because I wasn't completely happy with the design and construction techniques used for the Trestle Table in that issue. Then one of our readers wrote us to say that we should always keep that issue around . . . if only to remind us to do better in the future. So, it's back, and we're trying to do better.

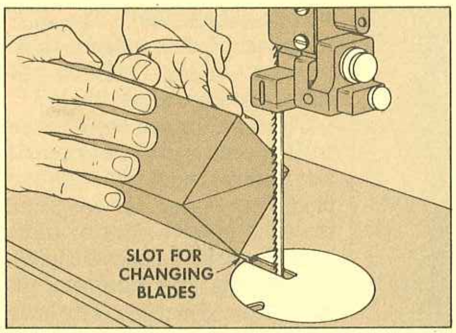
UPDATE. All the prices and information listed in this issue were current at the time of the original printing.

Tips & Techniques

FINDING CENTER ON SPINDLE STOCK

I've been using a simple way to find the center on the ends of spindle turning stock that might interest your readers.

All I do is use the band saw to cut the "cross-hair" slots on both ends of the stock. To do this, I position one corner of the stock in the table slot (that's used to change the band saw blades), and line up



the opposite corner with the band saw blade. Then I make the diagonal cut about ¼" deep, and rotate the stock to repeat the cut between the remaining two corners.

The center is marked where the two cuts cross, and the ¼" diagonal cuts also provide a good seat for the spurs.

Robert W. Ziegler
Winter Haven, Florida

COMMON CALIPERS

I came across an idea while I was turning forty identical spindles for a swinging cradle that may be of some help to someone else. To keep the diameter of the round tenons on the ends of each spindle consistant, I used open-end wrenches as a gauge, rather than the outside calipers.

First I turned the tenons with a gouge close to the right size. Then I used a parting tool to trim the tenon down to size until the respective wrench would slide over the tenon as it was turning. Often with a little pressure, the ends on the opening of the wrench would actually cut the tenon down to the exact size.

John H. Metzger
Port Washington, Ohio

ROUTER CUT MORTISES

I have an idea for those readers of *Woodsmith* who want to make exactly centered mortises, but who don't have a drill press. I use a simple jig and a router.

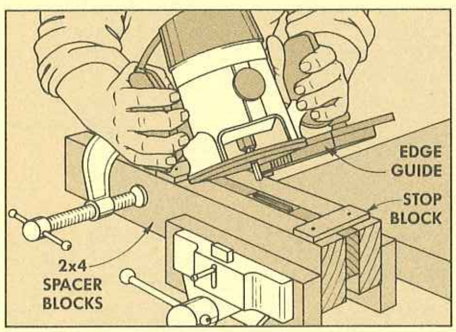
To make the jig, I trimmed two 2x4's to exactly the same thickness. Then I cut a spacer to exactly the same thickness as the piece being mortised. This spacer is screwed to the side of one of the 2x4's.

Then the piece being mortised is placed between the 2x4's (butted against the spacer, and flush with the top edge), and the whole arrangement is clamped together sandwich style. (I clamp the end with the spacer block in a vise, and the opposite end with a C-clamp.)

To cut the mortise, I use a router equipped with an edge guide that rides on the outside of the 2x4's, and a router bit that's slightly smaller than the mortise.

After the length of the mortise is marked out, I make the first cut using one side of the fixture as a guide. And then, without changing the setting on the edge guide, I make another cut using the opposite side of the fixture for the guide. This assures that the mortise will be exactly centered on the stock.

If more than one identical mortise is to be cut, a set of stops can be tacked to the top of the fixture. This set-up can also be



used to cut a groove along the piece to accept a panel.

This method may be of some value to those "router nuts" who want more information on how to use the router.

Jerry Schueller
Winona, Minnesota

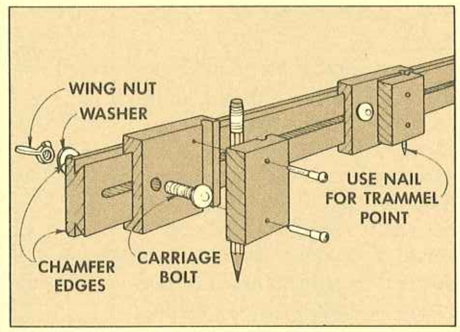
EDITOR'S NOTE: For more information on cutting mortise and tenons, see pages 7-11. And for a review of mortising bits, including router bits, see page 20.

BEAM COMPASS

There are times when I've needed a larger compass than is commercially available. To solve this problem, I made a simple, and very functional beam compass that incorporates a sliding dovetail joint. By using a sliding dovetail, the heads of the compass can be easily adjusted along the beam, while automatically remaining at a 90° angle to the beam.

To make the compass, I used a piece of ½" oak, 2" wide, and 36" long (any length will work). Then the first step is to cut dovetail grooves on the outside edges of the beam. To do this, I simply used a dovetail bit in the router table (see *Woodsmith* No. 20).

The next step is to cut a ⅜"-wide stopped groove (centered on the beam) to attach the adjustable heads. To mark the starting and stopping points of this groove, I drilled two ⅜" holes, centered 1" from both ends of the beam. Then I used a



straight bit on the router table to cut the groove.

To make the adjustable heads, cut the shoulders of the dovetails (on the router table) so that they're slightly closer together than needed to fit over the beam. Then remove the waste between the dovetails to form a large dovetail groove. (By removing this waste, I could actually test the heads against the beam for final fit.) Finally, the distance between the dovetails is widened until it fits on the beam.

After the heads are cut, ¼" holes are drilled for locking bolts (I used a ¼" x 1¼" carriage bolt). Then I made two holding brackets with custom-fit grooves to hold a pencil in one bracket, and a trammel point in the other. (The trammel point is made by grinding a sharp point on a #8 finish nail with the head removed.)

Finally, I used a chamfer bit on the router table to take off the corners of all the edges. To finish this beam compass, I used Watco danish oil, and a couple of coats of Watco satin wax.

Kenneth Gyldenvand
Des Moines, Iowa

SEND IN YOUR IDEAS

If you'd like to share a woodworking tip with other readers of *Woodsmith*, send your idea to: *Woodsmith*, Tips & Techniques, 2200 Grand Ave., Des Moines, Iowa 50312.

We pay a minimum of $10 for tips, and $15 or more for special techniques (that are accepted for publication). Please give a complete explanation of your idea. If a sketch is needed, send it along; we'll draw a new one.

Display Case

IT'S EASY, NO SPOOLING

Maybe I'm just behind the times, but just the other day I learned that thread no longer comes on wooden spools. Nowadays all thread is wound around *plastic* spools. As a result, wooden spools have become somewhat of a collector's item. And worthy of a display case.

We've had a lot of requests for plans for a small display case for thimbles, pipes, spoons, commemorative coins, and small car replicas. I don't have any of those things, but pack rat that I am, I have all sorts of wooden spools. So I decided this was a good opportunity to build a display cabinet for them.

THE BASIC BOX

The cabinet uses straightforward box construction: the top and bottom are joined to the sides with a rabbet/dado joint, and all three shelves are dadoes into the sides. This requires a total of five dadoes on each side piece, see Fig. 1.

I knew these dadoes had to line up perfectly on both side pieces. But rather than trying to cut identical dadoes on two individual pieces, I cut only one set of dadoes . . . in one double-wide piece. Then after the dadoes were cut, I could rip this double-wide piece to get the two pieces for the sides.

By this time, I was really getting into making things easy. To eliminate five individual setups for cutting these five dadoes, I decided to space the dadoes for the three shelves equidistant from both ends. This way, the set-up for the top shelf could also be used for the bottom shelf by simply flipping the piece end for end.

To start this process, I cut the double-wide piece 15" long by 4½" wide. (This is a little wider than needed to allow for trim cuts if any chipout occurs as the dadoes are cut.)

DADOES FOR SHELVES. I cut the dadoes for the shelves first. The dadoes for the top and bottom shelves are cut 3¾" from each end of the double-wide piece. And the dado for the center shelf is centered on the length — 7¼" from either end. All three of these dadoes are ½" wide by ¼" deep, see Fig. 1.

DADOES FOR CORNER JOINTS. Next, I cut the dadoes for the rabbet/dado joint (used to attach the top, bottom and two sides of the cabinet). These ¼"-wide dadoes are positioned so the bottom edge of the dado is equal to the thickness of the top/bottom pieces, see Fig. 3.

RIP TO SIZE. After all the dadoes were cut, I ripped the double-wide piece into the two 2"-wide side pieces (A). Then I cut a ½"-wide by ¼"-deep rabbet on the back edge of both sides pieces for the ¼" plywood back, see Fig. 4.

TOP AND BOTTOM PIECES

This same basic procedure can be used to cut the pieces for the top and bottom (B). First, I cut a double-wide piece to a length of 9½". (This length allows for 9" between the side pieces, plus ½" for the two ¼"-long tongues.)

Next, I cut a rabbet on the ends of the double-wide piece to leave a tongue that fits the dado in the side pieces. This is the rabbet half of the rabbet/dado joint. (Although it's called a *rabbet*/dado joint, the only purpose of the rabbet is to leave a tongue to fit in the dado, see Fig. 3.)

Finally, I ripped the double-wide piece to get the top and bottom pieces (B). These pieces are ripped ¼" *narrower* than the cabinet sides to allow room for the ¼" plywood back.

NOTCHES FOR HINGES. To mount the door, notches have to be cut for the hinges. But rather than waiting until the cabinet is assembled, I decided to go ahead and cut the notches now (while the sides were still easily accessible).

To simplify things, I cut these notches to a depth equal to the full thickness of the knuckle of the hinges, see Fig. 3. Then the hinge flap on the door frame could be surface-mounted (no mortise is needed on the door frame, refer to Fig. 8 on page 6.).

THE SHELVES

I decided to make the shelves for this cabinet ½" thick so they wouldn't look too bulky and detract from the relatively small collectibles. This meant resawing stock for the shelves down to ½" thickness.

Before resawing, cut to length the three pieces of stock for the shelves. To determine the length needed for the shelves, dry-assemble (no glue) the top, bottom and two sides to form the basic shell of the cabinet. Then measure the distance between the bottoms of the dadoes, and cut the stock to this length.

Next, rip these three pieces to a width of 1¾". (This is ¼" less than the width of the sides to allow for the plywood back.)

Finally, the three shelves can be resawed (ripped on edge) to fit the ½" dadoes in the cabinet sides. It's best here to set the cut to slightly over ½" because you need just a little extra thickness so the saw marks can be removed. (I used a cabinet scraper to remove the marks, but they

could also be sanded off.)

HOLES FOR DOWELS. If this cabinet is used for spools, a series of ⅜"-deep holes need to be drilled in the shelves for the pegs. I used a spacing of 1⅛" for the small-sized spools on the top two shelves; and a 1¾" spacing for the large spools on the bottom shelf and the bottom of the cabinet, see Fig. 2.

PEGS. Then the pegs for the spools are cut 1" long. I chamfered the top edge of these pegs by mounting them in the drill press (set at a slow speed), and used a file to knock off the edge.

ASSEMBLY. Next, the ¼" plywood back (H) is cut to fit between the rabbets in the cabinet sides, and equal to the full height of the cabinet.

Finally, the cabinet (top, bottom, sides, and shelves) can be glued together, with the plywood back tacked in place to help keep everything square.

TRIM PLATES

At this point the cabinet is just a plain box. So to spice things up I added decorative trim plates (D) to the top and bottom of the cabinet. The length of these plates is a total of ⅝" longer than the width of the cabinet. (This allows a 5⁄16" overhang on the outside edges, see Fig. 5.)

The width of these plates is equal to the depth of the cabinet (2"), plus the thickness of the door frame (13⁄16"), plus 5⁄16" for the overhang on the front. This totals 3⅛". But since the door frame isn't built yet, I cut them to rough width of 3¼" for now, and trimmed them after the door was built.

CHAMFER EDGES. Finally, the edges of these plates are chamfered (on the router table) to leave an ⅛"-wide chamfer on the front edges and both ends. (The edges on the back of the cabinet are left square, see Fig. 5.)

MATERIALS LIST

Overall Dimensions: 19¼"H x 11"W - 3"D

A	Sides (2)	13⁄16 x 2 - 15
B	Top and Bottom (2)	13⁄16 x 1¾ - 9½
C	Shelves (3)	½ x 1¾ - 9½
D	Top/Btm. Plate (2)	13⁄16 x 3⅛ - 11¼
E	Door Stiles (2)	13⁄16 x 1⅛ - 15
F	Door Rails (2)	13⁄16 x 1⅛ - 9⅞
G	Decorative Scroll (1)	13⁄16 x 3 - 8⅜
H	Plywood Back (1)	¼ x 10 - 15

CUTTING DIAGRAM

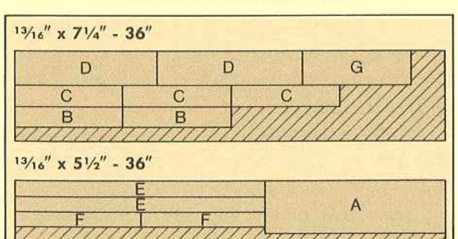


FIGURE 1

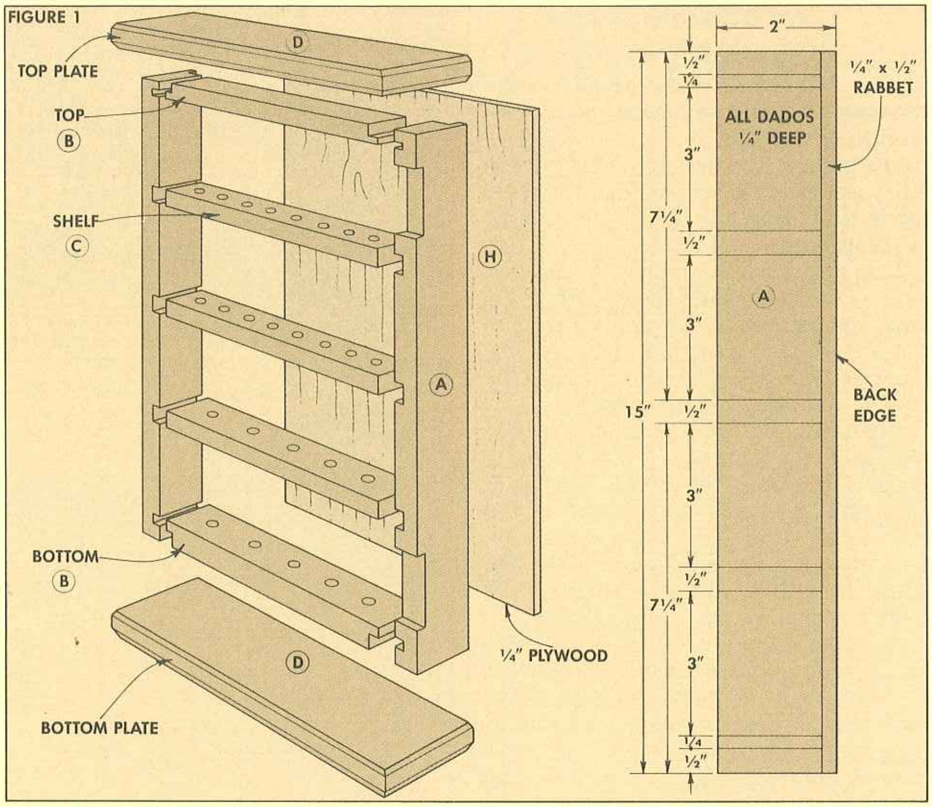


FIGURE 2

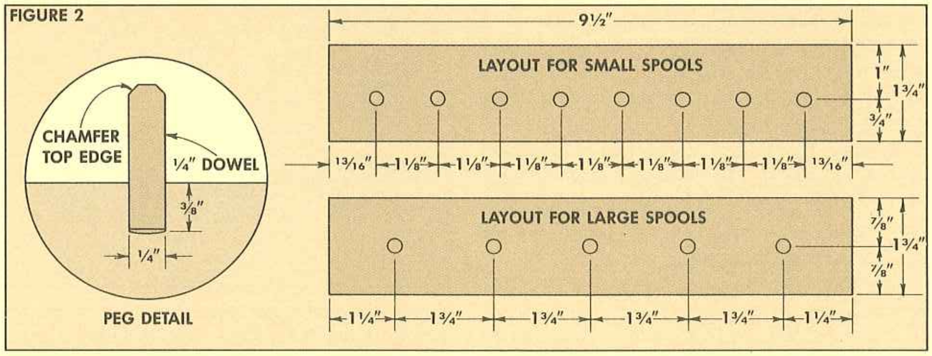


FIGURE 3

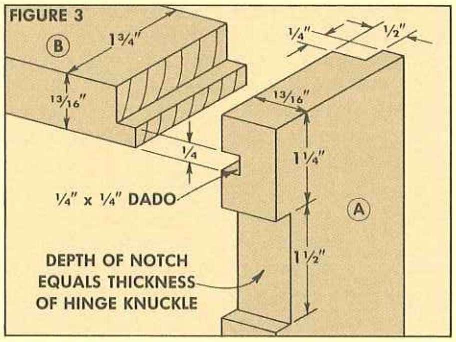


FIGURE 4

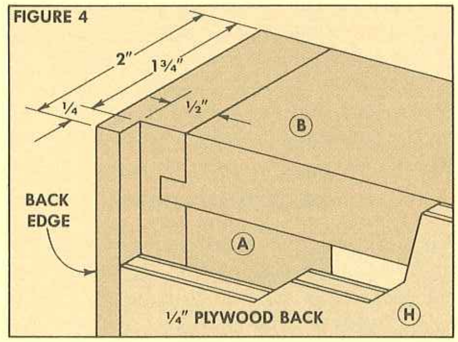
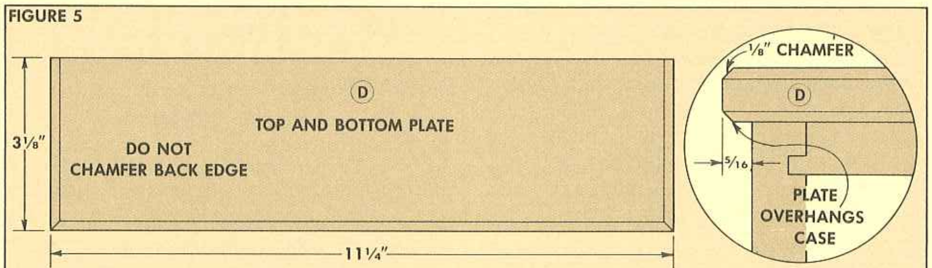


FIGURE 5



THE DOOR FRAME

The door of the spool cabinet is constructed with simple mortise and tenon joinery. (See pages 7 to 11 for a detailed description on cutting this joint.)

THE STILES. The first step is to cut the stiles and rails 1⅛" wide. Then the stiles can be cut to length to equal the full height of the cabinet.

This dimension is actually a little too long — the door would fit too tightly between the top and bottom plates. But since the plates aren't mounted yet, I cut the stiles to full height first, and trimmed the door to size after it was assembled.

THE RAILS. The rails are cut to length so the final width of the door frame is equal to the outside width of the cabinet, see Fig. 6. (The shoulder-to-shoulder length of the rails equals the outside width of the cabinet, minus the combined width of the two stiles. Then to get the total length of the rails, I added 1½" for the two tenons.)

After the rails and stiles are cut to size, I cut ¼"-wide mortises in the stiles, and cut the tenons to fit the mortises. When all the joints are cut, glue the door together, making sure it's square and flat.

TRIM DECORATIVE PLATES. Once the door was assembled, I backtracked and found the final width for the top and bottom plates (D). Then these two plates are trimmed to width and glued to the cabinet so they're centered on the width, and flush with the back edge.

Finally, I trimmed the height of the door frame to allow clearance between the plates. (Trim a hair off both the top and the bottom of the door frame, so the width of the rails remains equal.)

RABBET FOR GLASS. To install the glass in the door frame, I routed a ¼"-wide by ½"-deep rabbet on the back of the frame, see detail in Fig. 7. (The routing technique I used to eliminate any chipout on the edge of the rabbet is described on page 22).

CHAMFER. Finally, I sanded the door frame, and then routed a stopped chamfer on the outside edge of the stiles, see detail in Fig. 6.

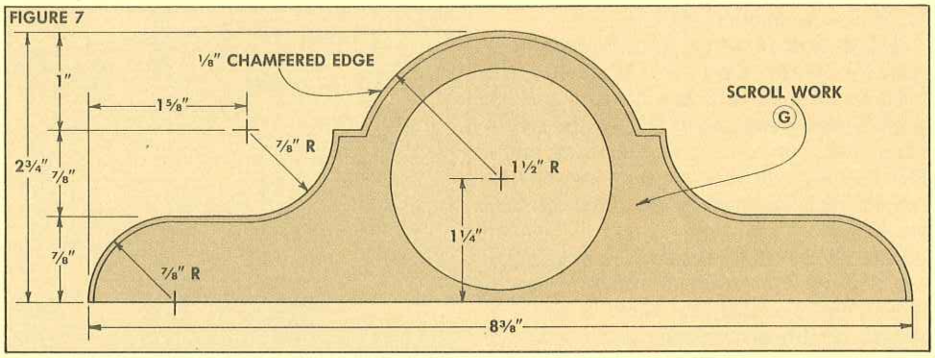


FIGURE 7

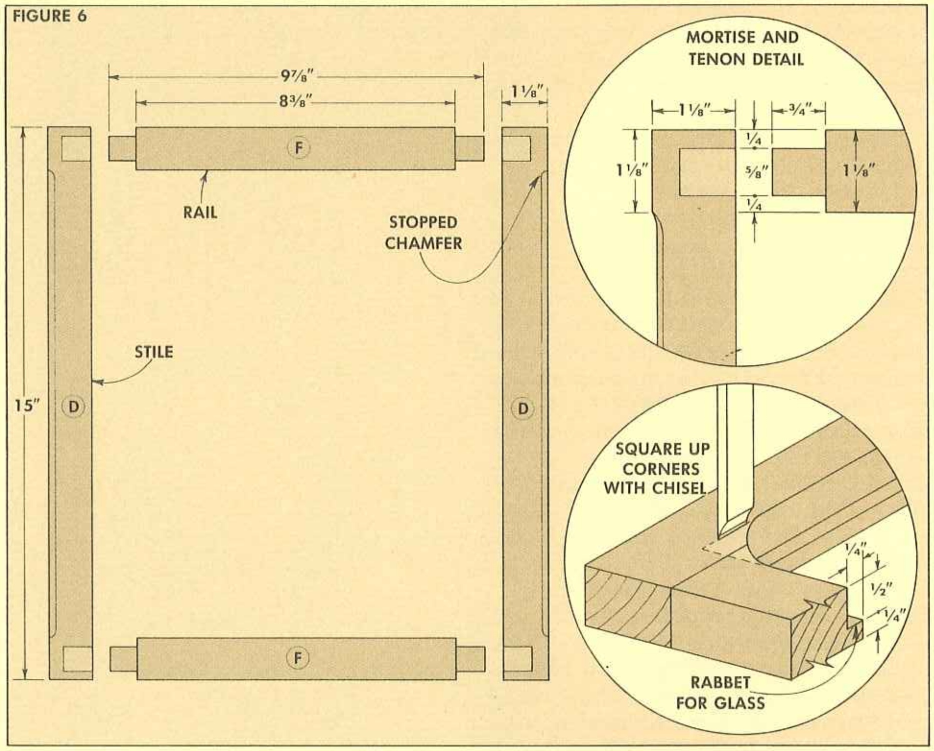


FIGURE 6

THE SCROLLWORK

Now for the tricky part: the scrollwork with the inlaid starburst. Although this is not completely necessary, it turned out to be a lot of fun. (That is, once I got over my initial fear of screwing it up.)

The first step is to mark the outline of the scrollwork on a piece of stock 2¾" wide by 8⅜" long. (All of the necessary dimensions are shown in Figure 7.) When the outline is marked, be sure to include the center point of the circle for the starburst. Then cut the outline on a band saw, and sand the edges smooth with a drum sander (on a drill press).

CHAMFER EDGES. To soften the edges of the scrollwork, I routed a ⅛"-wide chamfer along its front edge. The easiest way to do this is on a router table with a chamfer bit equipped with a pilot guide.

Unfortunately, the pilot prevents the bit from completely chamfering the inside corners of the profile. So I wound up using a sharp chisel to touch up the areas missed by the router bit.

MOUNT THE INLAY. Next, a circular recess is cut for the starburst inlay. Since this inlay is a circle, the recess is relatively easy to cut with an expansion bit on a drill press. (The details for cutting the recess and mounting the inlay are described in Shop Notes, page 22.)

MOUNT TO CABINET. After the inlay is mounted, the scrollwork is glued to the top of the cabinet.

DETAILS, DETAILS

At this point, all that's left are the little details that always seem to be left until the last moment (not necessarily because it's the natural time to do them, but because I've finally finished all the fun parts.)

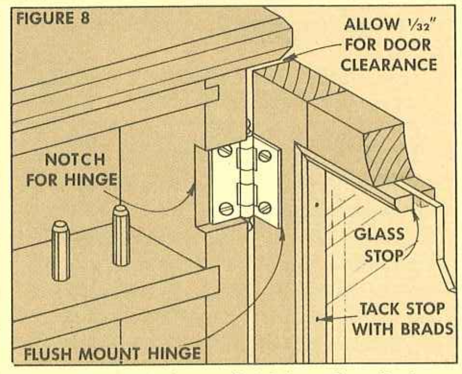


FIGURE 8

The first of these finishing details is to cut the stops to hold the glass in the door frame, see Fig. 8.

Next, I installed the hinges. I used brass butt hinges on this cabinet and mounted them in the mortises cut on the edge of the cabinet sides.

Finally, I mounted a magnetic catch inside the cabinet, and installed a ceramic knob on the door.

I finished this cabinet with two coats of Minwax Antique Oil Finish.

Joinery: Mortise and Tenon

THE BASICS OF BUILDING A FRAME

Although we've shown several variations of mortise and tenon joints in past issues of *Woodsmith*, this time we're showing only the basic joint . . . but we're including all the "tricks of the trade" we've learned to achieve good results.

The procedure we follow is not intended to cut one pretty joint just to show off. Rather, the point is to cut four joints to form a good, sturdy frame . . . one that's square and has no twist to it.

Building a mortise and tenon frame involves several techniques, yet the entire process depends on four basic rules:

1) Use good straight lumber.

2) Plan all cuts so you're working with "standard" pieces and settings. That is, once you set up for a cut, don't change it. Go ahead and cut all pieces with exactly the same setting.

3) Make trial cuts each step of the way.

4) Be patient. There's no rush to get things done.

The full description of this procedure may seem overly detailed — like there's a tremendous amount of time and work involved. But once you're in the shop and actually start cutting the joint, things move along at a pretty good pace . . . fast enough to get the job done, but carefully enough to get it done right.

THE INITIAL PROCEDURE

Whenever I set out to build a frame, the first step is to determine the final size I want the frame to be. There are two choices: you can build the frame so the *outside* dimensions are a certain size, or build it so the *inside* dimensions are a certain size. As an example, I built a sample frame with outside dimensions of 12″ high by 11″ wide.

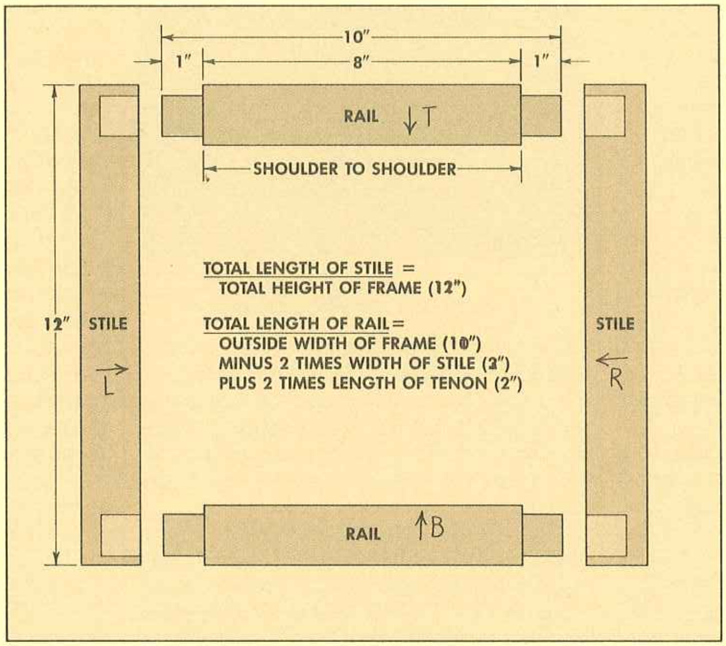
1. **STILES AND RAILS.** To build a frame this size, the stiles (vertical pieces) will be 12″ long, which is the final outside height of the frame. The length of the rails (horizontal pieces) is determined by this simple equation: rail length =

(final outside width of frame)
minus (2 times the width of the stile)
plus (2 times the length of the tenon).

To use this equation I had to fill in the two variables: the width of the stile, and the length of the tenon. I chose a width of 1½″ for the stiles.

Things get a little complicated when figuring the length of the tenon. In general, the tenon should be at least ¼″ *less* than the width of the stile. That is, you want to leave ¼″ between the bottom of the mortise and the outside edge of the stile. If the stiles are 1½″ wide, this would mean a tenon length of 1¼″.

However, another limiting factor for the tenon is the depth of the mortise. I like to use Sears mortise bits which drill comfortably to a depth of 1″. So I reduced the length of the tenon for the sample frame to 1″ (which is also an even measurement that's easy to work with so there's less chance of a measuring error.)



Back to the equation. The final outside dimension of the frame is 11″. Minus 3″ (which is 2 times the width of the stile.) Plus 2″ (which is 2 times the length of the tenon). Thus, the rail length equals 10″.

2. **CHOOSING THE WOOD.** When choosing the wood to build a frame, it's important to choose good straight lumber — no warp, no twist, no cup. No matter how well the joints are cut, if the wood is warped, or especially if it's twisted, the frame will be goofed up.

I also try to choose a piece that's oversized so there will be some scrap left over for trial cuts. When the scrap comes from the same board as the rails and stiles, you know the setting on the trial cuts will apply to the "real" pieces. (For the sample frame I chose a piece of hardwood 3½″ wide by 36″ long.)

3. **CUT TO LENGTH.** To start, I cut rough-length sections for the stiles and rails ½″ longer than needed. Then the section for the stiles is cut to final length. (The rails are cut to final length later.)

When cutting to final length, I use a double-cut procedure, trimming one end of each board square, and then trimming the other end to the final length.

To make these cuts, I use the panel cutting jig shown in *Woodsmith* No. 25. This jig helps hold the board so you can make good, square cuts.

4. **RIP TO WIDTH.** Next I set up the saw to rip the stiles and rails to final width (1½″ wide). Again, all pieces are double-cut. First rip them about ⅛″ wider than needed, and then trim them to final width. This double cutting allows you to rip both edges of each piece so you know you're working with two clean edges.

5. **CHECK FOR WARP.** Although I use good straight lumber at the outset, sometimes internal stress in the board causes the pieces to go "crazy" as they're ripped.

The worst thing to contend with is pieces that are twisted. To check for twist, lay each workpiece on a flat surface (I use the top of the table saw), and see if you can rock it by applying pressure to opposite corners. If any of the pieces are twisted, set them aside and cut replacements that are truly flat and straight.

6. **LAY OUT GRAIN PATTERN.** At this point both the stiles and rails have been cut to "standard" width and the stiles have been cut to final length. (The rails are cut to final length later — when the tenons are cut.)

The next step is to lay out all of the pieces in their respective positions to form the frame. Then I start shuffling the pieces until they have their best face forward, and they're arranged with a nice grain pattern.

7. **MARK EACH PIECE.** When all the pieces are arranged the way I want them, I mark each piece so there's no confusion later. I usually just draw an arrow on the face side (the side that will face out). This arrow points toward the inside edge of the frame.

I also mark each piece so I know which is right (R), left (L), top (T), and bottom (B). Then I'm ready to cut the mortises and tenons.

Slot Mortise

GETTING IT CENTERED IS THE KEY

The difficulty in cutting a mortise and tenon joint is that it's two separate operations. Yet the end result must be one perfectly matched joint. This problem is magnified when building a frame simply because there are four joints to contend with.

The key to making four good joints is to make each mortise and each tenon with standard settings — so they're all the same and don't have to be "customized."

So which do you cut first, the mortise or the tenon? I think it's best to cut the mortise first because one of its dimensions (the width) is limited to the size of the bit used to drill it out. The tenon, on the other hand, is exposed and relatively easy to get to if its dimensions need to be altered.

LAYING OUT

The first step for cutting a mortise is to lay out the dimensions (the width, length, and depth) on the edge of the stile. I make these layout marks on only one stile. Then this stile is used to set up a fence arrangement on the drill press to cut all the mortises with standard settings.

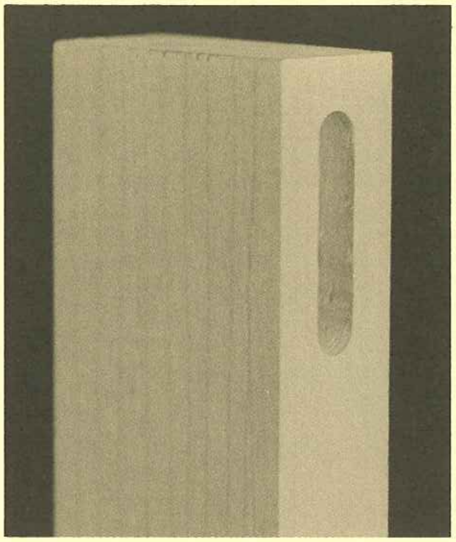
1. DETERMINE WIDTH. The width of a mortise is limited to the diameter of the bit you're using. In general, the mortise should be one-third the thickness of the stock you're working with. For 13⁄16"-thick hardwood, I cut a 1⁄4"-wide mortise.

2. MARK LENGTH. As for the length of the mortise, once again there are certain limitations. The mortise should stop far enough from the end of the stile so it doesn't split out the end of the stile. Usually 1⁄4" from the end is enough to eliminate any problems.

The other end of the mortise is limited to the width of the rail. (Since the tenon can't be any wider than the width of the rail, the mortise is also limited to this size.) I mark a boundary line on the stile equal to the width of the rail, see Fig. 1.

Now the other end of the mortise can be marked. This is where some consistency pays off. Since the first mark was made 1⁄4" from the end of the stile, the second line should be marked 1⁄4" from the boundary line, see Fig. 2. (This will simplify cutting the tenons later.)

3. MARK DEPTH. Finally, the depth of the mortise is marked on the end of the stile, see Fig. 3. For the sample frame, I marked the depth at 1". (Note: when the depth of cut is set on the drill press, it's best to lower the bit just slightly more than this line to be sure the bit actually cuts to full depth.)



SETTING UP THE FENCE

All of these layout marks are used to set up the fence, stops and feather board used to hold the stile in place as the mortise is drilled. An overview of this setup is shown in Figure 4. (The construction details for this fence are described at the end of the article.)

Shop Note: The bottom corners of the stops should be chamfered to allow a sawdust relief. Also the feather board is raised up with a small block so it exerts pressure on the top edge of the stile. This is where all the action is, so you want the most support here.

4. CENTER STILE ON BIT. To set up the fence, the first step is to position the fence so the stile is centered on the bit. This is the critical step. Although it's possible to make alterations later, things will go a whole lot smoother from here on if the mortise is exactly centered on the stile.

To get the proper setting, I use a piece of scrap to make trial cuts. Place the scrap against the fence and adjust the fence so the bit is approximately centered on the thickness of the scrap.

From here, the procedure varies slightly depending on the bit used. (For a review of five mortising bits, see Tools of the Trade, page 20.)

The bit I use most often is the Sears Mortise Bit. The procedure in this case is to drill a shallow test hole in the scrap piece — just deep enough so the bit forms a complete circle. Then flip the scrap piece around so the other face is against the fence. Lower the bit to see if it drills in exactly the same hole, see Fig. 5. (This may take quite a few trial cuts, but the effort spent now will pay off later.)

If I'm using one of the routing bits (like the Inca mortising drill), I've found it's easier to rout a shallow mortise at the end of the scrap. Then flip the scrap around and lower the bit to see if it knicks one side or the other, see Fig. 6.

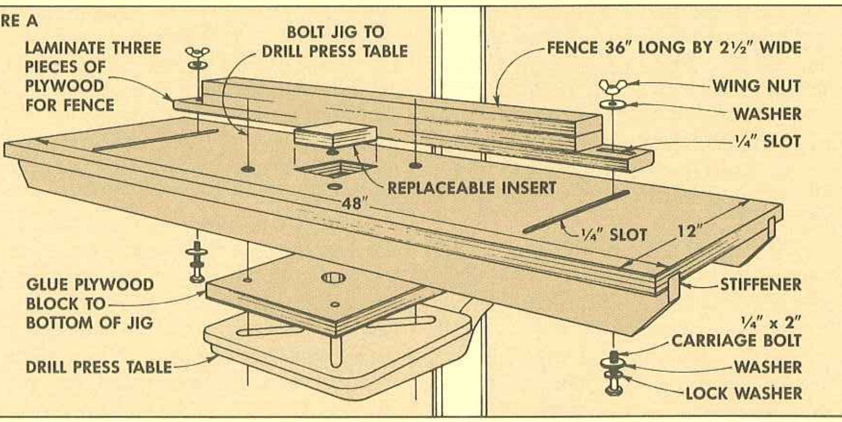
5. DRILL END HOLES. Now you're ready to drill out the mortise. I start by drilling the two end holes to define the final length of the mortise, see Fig. 7. This is done with the face side (the side marked with an arrow) of the stile against the fence.

6. CLEAN OUT. After the end holes are drilled, the rest of the waste is removed. When I use the Sears Mortise bit, I drill a series of barely overlapping holes between the end holes, see Fig. 8.

After this first series of holes is drilled, there will be small V-shaped shoulders along the cheeks of the mortise. I center the bit over each "V" shoulder and drill straight down on them. The bit may tend to argue a little when removing the V-shoulders, so I make repeated, shallow cuts until the V's are drilled to full depth.

7. MORTISE OTHER END. Up to this point all of these steps were for drilling one

FIGURE A



mortise on one end of the stile. This stile was positioned with its face side (the side marked with an arrow) against the fence.

To cut the other end, the stile has to be turned around. But this puts the face side out. And if the bit is not exactly centered on the thickness of the stile, the mortises at each end will be off-center in different directions.

Just to maintain consistency, I cut only one end of all stiles first (with the face side against the fence). Then I reposition the stop blocks so I can keep the face side of the stile is against the fence when cutting the mortises at the other end.

8. **CHOP SQUARE.** When all the mortises are cut, you should have perfect slot mortise on all the stiles. From here you have one of two choices:

1) Leave the ends of the mortise rounded, and round over the tenon to match.

2) Square up the corners of the mortise with a sharp chisel to accept the square corners of the tenon. To do this, start by chopping down on the end of the mortise with a sharp chisel, see Fig. 9. Make light taps and pry out the waste until you reach the bottom of the mortise. Then clean up the corners by paring down on the cheeks.

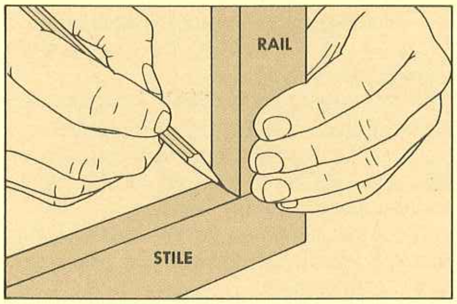
FENCE FOR DRILL PRESS

The jig I use for drilling out the mortises is simply a ¾" plywood base with a movable fence. To build this fence arrangement, cut the base about 12" wide by 48" long. Then cut two grooves on the bottom of the base, and glue in the two stiffeners, see Fig. A.

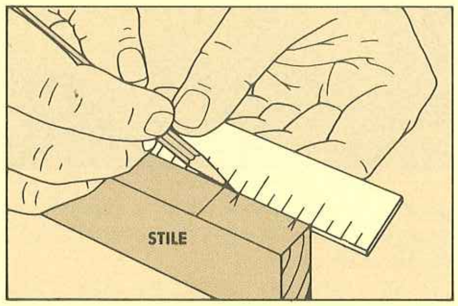
Next, rip three more pieces of plywood 2½" wide for the fence. (Two of these pieces are 30" long, and the bottom piece is 36" long.) These three pieces are glued and clamped together. When the glue is dry, rip a clean edge on both faces. Also, cut a chamfer on the bottom edge of the fence as a sawdust relief.

To attach the fence to the base, drill a series of ¼" holes at each end of the fence to form 2"-long slots, and another series of ¼" holes at each end of the base to form 6"-long slots. Then clean out these slots with a sabre saw and file. And finally, use carriage bolts to fasten the fence to the base.

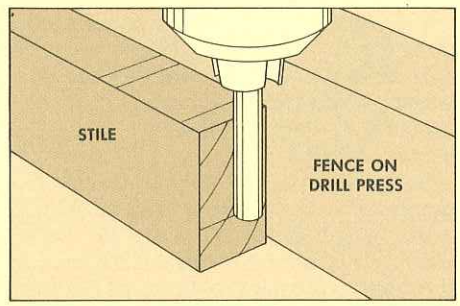
To prolong the life of the base, I cut a 3" x 3" square hole (with a sabre saw and cleaned up the edge with a router). Then I glued a backing piece to the bottom of the base, and cut a replaceable square to fit the square hole.



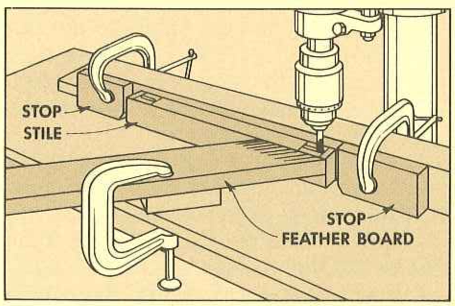
1 *The length of the mortise is limited to the total width of the rail. So the first step is to hold the rail at the end of the stile and mark a boundary line.*



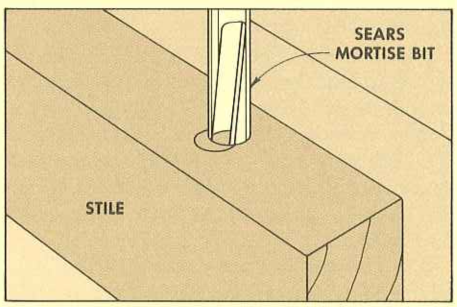
2 *Next, the final length of the mortise is marked. Mark one line at least ¼" from the end of the stile. Then mark the other line ¼" from the boundary line.*



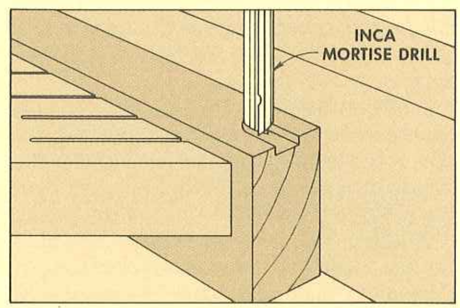
3 *Mark the depth of cut on the end of the stile. Then when setting the depth of cut, lower the bit a little more than this mark to be sure the bit cuts to full depth.*



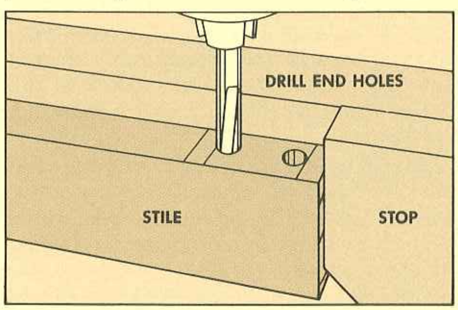
4 *Use the lines on the stile to set the stop blocks for the maximum length of the mortise. Then fasten the feather board in place using a block to raise it up.*



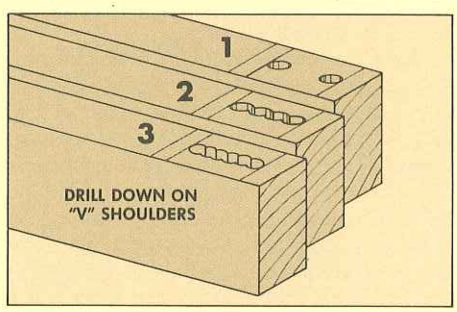
5 *Use a piece of scrap to center the bit. Place the scrap against the fence and make a shallow hole. Then flip around it to see if second hole matches the first.*



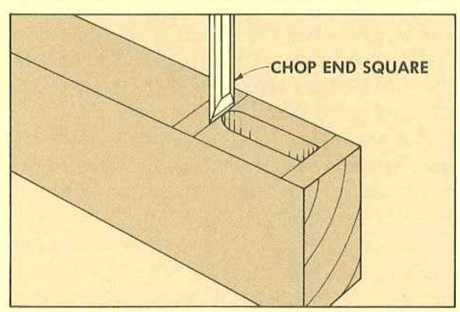
6 *To center the stile if a routing bit is used, rout a shallow mortise on the end of the stile. Then flip scrap around to see if the bit knicks one side or the other.*



7 *Place the stile with the face side against the fence. Then start the mortise by drilling the two end holes to define the total length of the mortise.*



8 *After the end holes are drilled, drill a series of overlapping holes to clean out the waste. Then drill down on the V shoulders, and make a final routing pass.*



9 *If you want a mortise with square corners, start by chopping straight down at the ends. Then clean up the corners by paring down on the mortise cheeks.*

The Tenon

TWO PROBLEMS: THE SHOULDER AND THE FIT

When making a mortise and tenon joint there's a tendency to concentrate on the fit of one tenon in one mortise. However, when building a frame, the rails have two tenons, one at each end. And this situation introduces another critical measurement: the distance between the shoulders of the two tenons.

This shoulder-to-shoulder distance must be exactly the same on both rails, or the frame will be out of square. The method we use to cut the tenon is intended to get the tenon to fit the mortise, as well as produce the correct shoulder-to-shoulder distance.

1. LENGTH OF RAIL. First, the rails have to be cut to final length. (The rails were only cut to rough length earlier.) The final length of the rails is determined by the shoulder-to-shoulder distance, plus the length of *both* tenons.

Going back to the sample frame, the problem is to build a frame with an outside width of 11". If the stiles are 1½" wide, then their combined width is 3". Thus, the shoulder-to-shoulder distance of the rails must be 8". The other variable (the length of the tenon) is equal to the depth of the mortise (1" deep).

Adding these variables together (8" for the shoulder-to-shoulder distance, plus 2" for the two tenons) equals the final length of the rail (10"). Trim the rails to this final length.

2. DEPTH OF CUT. Once you have this measurement, the basic technique for cutting a tenon is to lay the rail flat on the table saw and make multiple passes over the blade to clean off the face of the tenon.

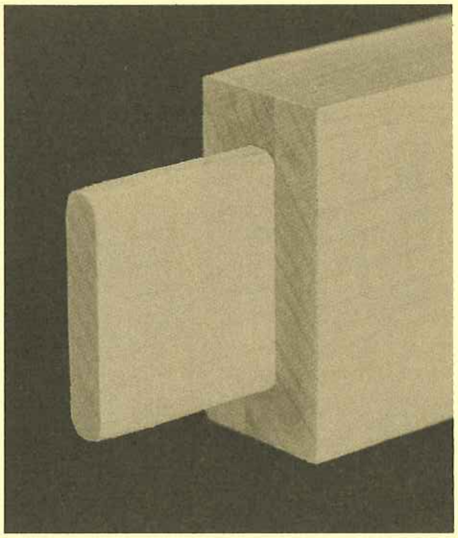
The first step here is to set the height of the saw blade to cut the tenon to the proper thickness. To do this, I use the mortise as a gauge.

Ideally, the mortise is centered on the stile, so it shouldn't matter which face of the stile you lay down on the table to set the blade height. But just in case the mortise is off-center, I work from the face side of the stile to begin with. (The face side is the side that was marked with an arrow at the beginning of all this.)

Place the face side of the stile *down* on the table and raise the blade until the highest point of one tooth lines up with the cheek of the mortise, see Fig. 1.

3. TRIAL CUT. Since the mortise is used as a gauge, this setting should be right on the money. But it's always best to make a trial cut on a piece of scrap to check it out, see Fig. 2.

Place the trial cut next to the cheek of the mortise to see if the depth of cut lines up with the mortise, see Fig. 3. It may take several trial cuts to get the correct height for the saw blade.



4. SHOULDER SETTING. As mentioned earlier, the tenon is cut by making multiple passes over the blade. The important thing here is to stop right at the proper shoulder line . . . on all pieces. To do this, I use the fence on the table saw as a stop to limit the length of the tenon.

Shop Note: There is a rule in woodworking that the fence and the miter gauge cannot be used together. This rule is true if you're making a through cut that will leave a chunk of waste between the blade and fence. But in this case there's no waste for the blade to throw, so the fence can be used as a stop.

For the sample frame, the shoulder setting is 1" (which is the length of the tenon). Adjust the fence so it's 1" from the *outside* (left) edge of the blade.

5. CUT FACE OF TENON. At this point, the depth of cut is established, and the fence is set for the shoulder distance. Now the tenons are ready to be cut.

Start by placing the rail with the face side *down* on the table saw. Note: Since the depth of cut was established with the face side of the *stile* down (the side with an arrow marked on it), the *rail* should also be cut with the same face down.

Cut the tenon (with multiple passes) by guiding the rail with the miter gauge. The last pass will be the shoulder cut (when the end of the rail is against the fence), see Fig. 4.

6. SMOOTH THE FACE. As the face of the tenon is cut, the saw blade will leave a rather rough surface. To smooth the face (after it's completely cut), position the rail over the apex (highest point) of the blade. Then gently move it back and forth over the blade while slowly moving the miter gauge forward and back. The high points of the blade will remove the roughness from the entire face of the tenon, see Fig. 5.

7. CUT OTHER END. When one end of the rail is complete, turn it around (end for end) to work on the other end. (Again, keep the face marked with the arrow down on the table.)

When the other end is cut, the rail should look like it has two half-laps, and the shoulder-to-shoulder distance should be what you want (8" for the sample frame), see Fig. 6.

8. CUT OTHER SIDE. Before cutting the opposite faces duplicate these first cuts on a piece of scrap. Then flip the scrap over and make a narrow cut out at the end to make a sample tenon, see Fig. 7.

If the sample tenon fits the mortise after this cut, go ahead and cut the other two faces of the tenon.

If the sample tenon is either too tight or too loose, it means the mortise is not centered. In this case you have to cut the tenon off-center by the same amount as the mortise.

To do this, adjust the height of the saw blade and make trial cuts on the scrap piece until the tenon fits snugly in the mortise. (It's better to have the fit a little on the tight side, than too loose.)

9. 3RD AND 4TH SHOULDERS. The thickness of the tenon should be perfect now. All that remains is to cut the 3rd and 4th shoulders so the tenon fits the length of the mortise (all the way to the rounded ends).

I usually just sneak up on this cut by making trial cuts out at the end of the tenon, see Fig. 8. When the 3rd shoulder lines up, flip the rail over and cut the 4th shoulder.

10. FINAL FITTING. Now for the final fitting. If the ends of the mortise are round and you want to leave them that way, you have to round over the corners of the tenon. I do this with a four-in-hand rasp, see Fig. 9.

As you're fitting the tenon into the mortise, the ideal situation is that the tenon will slide in with hand pressure only. However, there's usually a little chunk of something in the way.

Before I get out the chisel, I try to gently tap the tenon home with a hammer. If gentle tapping doesn't work, don't try to pound the tenon in (this may split the cheeks of the mortise). Instead, use a

chisel to clean out the mortise, or pare down the face of the tenon.

Since this joint is blind, you can't see what's going on when it's assembled, and problems are difficult to find and correct. Intuition is the best tool. I try to imagine myself inside the joint looking around for problem areas. Then I take it slow. A little bit of correcting can go a long way.

Once the tenon does slide in, check to see if the shoulders rest firmly on the edge of the stile. If there's a little gap, check around the base of the tenon to see if there's a little chunk of waste that needs to be chiseled away.

If the base of the tenon is clear and the shoulders still don't rest on the edge of the stile, the tenon is probably just a hair too long. Trim about 1/16" off the end of the tenon and try the fit again.

GLUING UP THE FRAME

At this point all four joints for the frame should fit perfectly. Now for the big question: Is the frame square and flat? To check out the frame, dry-assemble the rails and stiles. (At this stage, don't use clamps, and don't apply any glue.)

CHECK FOR TWIST. Lay the frame on a *flat* surface and try to rock it at opposite corners to see if it is twisted. Twist is the worst thing to contend with. But it usually doesn't occur if the wood is straight to begin with.

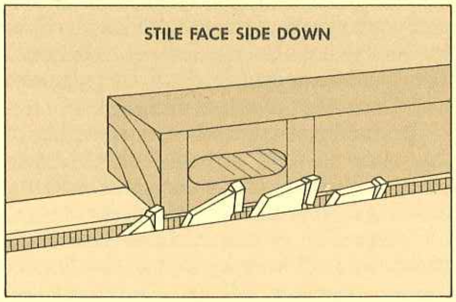
Once again, use intuition to correct any problems . . . and take it slow.

CHECK WITH CLAMPS. When everything goes together like it's supposed to, the frame can be dry-clamped (no glue yet) to test the effect the clamps have on the squareness of the frame. (You only need a bar or pipe clamp at each end of the frame — clamping the stiles against the shoulders on the rails.)

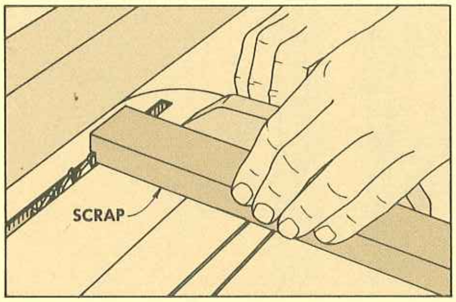
Place the clamps on a flat surface and position the rails and stiles. Then as the clamps are tightened, don't apply too much pressure (this can twist the frame). Use a try square to check the frame for square.

GLUE UP. If it all checks out, loosen the clamps and apply a little glue in the mortise (I use a Q-tip). And brush on a little on the tenon. Then tighten the clamps. Rushing at this stage can goof up a lot of work. Take as much time as needed to make sure the frame is square as the clamps are tightened.

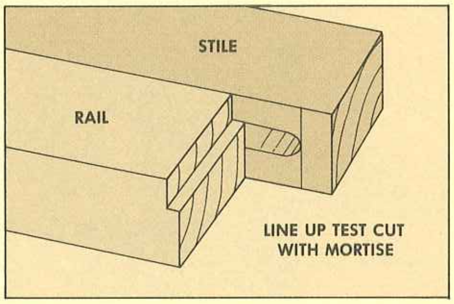
Wait about 2 hours for the glue to set and then remove the clamps. You should have a perfect mortise and tenon frame.



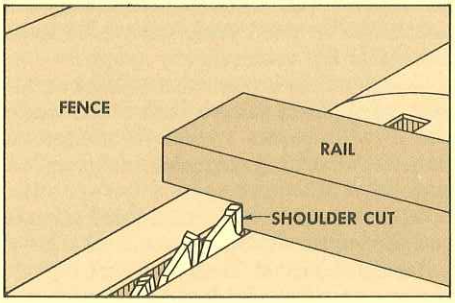
1 *To set the depth of cut, place the stile face down on the table. Raise the blade so the highest tooth lines up with the bottom cheek of the mortise.*



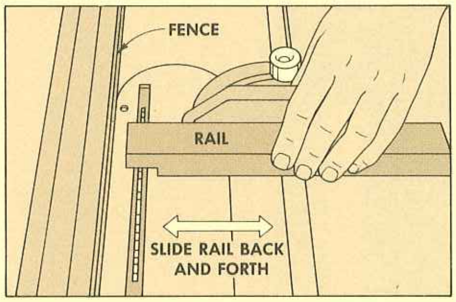
2 *Although this depth setting should be correct, use a piece of scrap to test the depth of cut. Make a cut at the end, guiding the scrap with the miter gauge.*



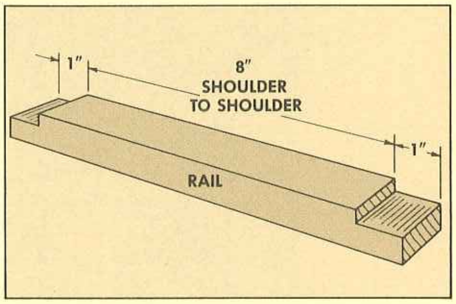
3 *To check the depth setting, place the trial cut next to the mortise (face side up on both pieces) to see if the cut lines up with the cheek of the mortise.*



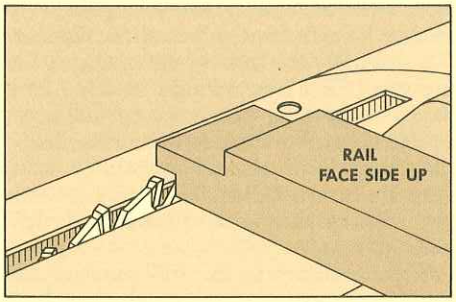
4 *Set the fence so the distance to the outside of the blade equals the length of the tenon. Then make repeated passes to cut the face of the tenon.*



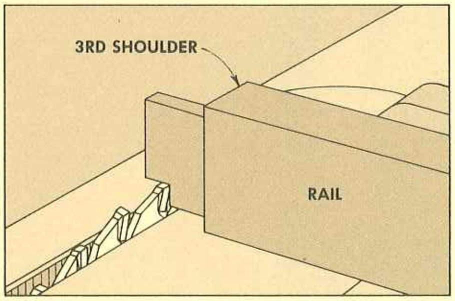
5 *To clean off the face of the tenon, push the rail back and forth over the highest part of the blade, while moving the miter gauge forward and back.*



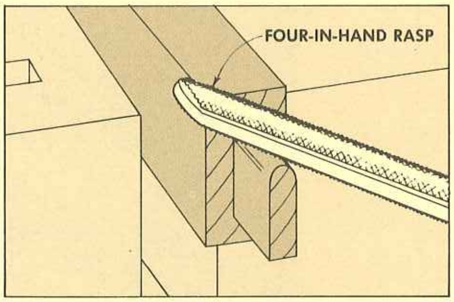
6 *Turn the rail end-for-end (keeping the face side down) and make same cut at other end. Check the shoulder-to-shoulder distance between the tenons.*



7 *To complete the tenon, turn it over (so face side is up) and repeat Steps 4 and 5, starting out at the end of the tenon and ending at the shoulder cut.*



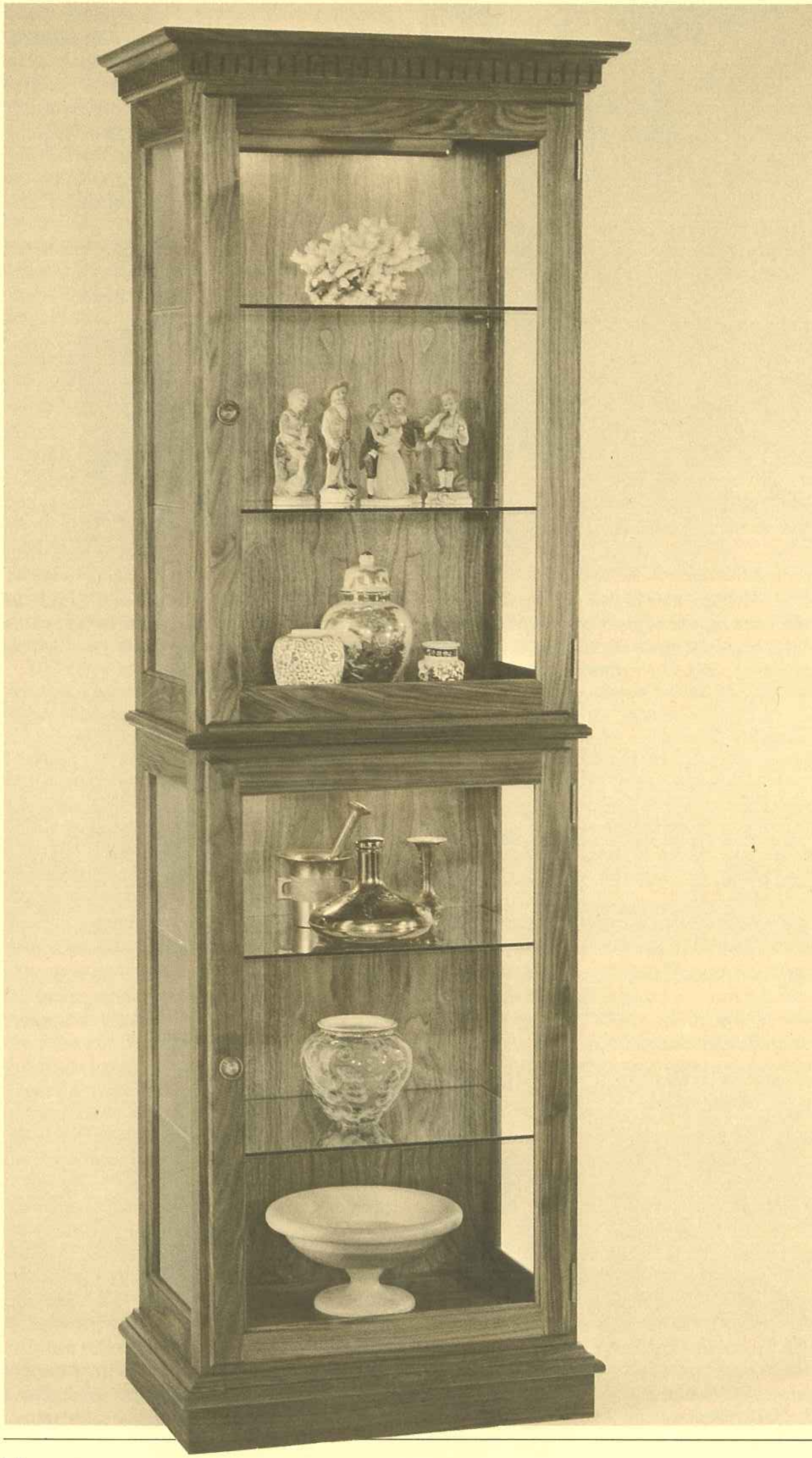
8 *To cut the 3rd and 4th shoulders, turn the rail on edge and sneak up on the cuts until the width of the tenon matches the full length of the mortise.*



9 *If you left the ends of the mortise round, the corners of the tenon need to be rounded to match. Use a four-in-hand rasp to gently round-over the corners.*

Curio Cabinet

A CABINET THAT'S WORTHY OF DISPLAY



There are two ways to look at a curio cabinet. To someone who has valuable collectibles, a cabinet like this is a nice way to show them off, while keeping them out of harm's reach.

A woodworker, however, might very well ignore the items on display and concentrate on the construction of the cabinet itself. He/she wouldn't open the door to get a better view of the collectibles, but rather to see how the glass was installed, or to see if the joint lines on the back of the door fit as well as those on the front.

When you set out to build a curio cabinet, you know that the cabinet itself will be on display just as much as its contents. This just means taking a little extra time to make sure things are done right.

To simplify things, the construction of this curio cabinet is based on only two things: building frames, and cutting molding strips. But to complicate things, the sequence of construction is a little backwards. (The reason for the "backwards" approach will be clearer as this story unfolds.)

THE DENTIL

Most of the visual impact of this cabinet is the result of the molding — especially the dentil (the strip of evenly spaced blocks at the top of the cabinet).

This dentil (I) is made by cutting a series of ¼"-wide kerfs along a board to produce the ½"-wide blocks. (A complete description of the cutting procedure is given on page 22.)

THE PROBLEM. When this dentil strip is cut to length, it looks best if there's a full-width block at each end, see Fig. 1. But this creates a problem. If the cabinet is built first, it's almost impossible to cut the dentil with the proper spacing to get a full-width block on each end.

THE SOLUTION. Instead, I cut the dentil first, and used it as a "measuring stick" to gauge the cuts for the rest of the cabinet. The dentil for the front of the cabinet is the key one. This piece should be 22¼" long . . . if everything works out perfectly.

However, the actual length of the dentil may have to be altered slightly to make sure there are full-width blocks at each end. (There should be a total of 30 full-width blocks.)

The dentil strips for the sides of the cabinet are not quite so critical. I cut them to rough length at first. Then, during the final assembly stages, they can be trimmed to fit the cabinet.

OTHER MOLDING STRIP. After the dentil

is made, one more molding strip (J) should be cut — the one that fits below the dentil. The top edge of this strip is rabbeted to accept the dentil. Then the bottom edge is cut with a ¼″ corner-round bit, leaving a 3⁄32″ shoulder, see Fig. 2.

To get the final length of this molding strip, use the "heel-to-heel" distance of the dentil (the distance between heels of the miter on the backside of the dentil), and cut it to length, see Fig. 2. When this molding strip and the dentil are cut to final length, you can start on the web frames.

WEB FRAMES

This curio cabinet is built as two separate units. And in keeping with the odd sequence of construction, I built each unit inside out. That is, I started with the web frames (the top and bottom of each unit).

There are four web frames in all (two for each unit). The key one is the top web frame (for the top unit). It must be sized according to the final length of the dentil and molding piece that were just cut. Then the other three web frames are cut to match the top one.

RAILS AND STILES. The rails (front and back pieces) and the stiles (side pieces) are ripped to a width of 1¾″. To determine the lengths of these pieces takes a little figuring.

To get the length of the rails, measure the distance between the shoulders of the corner-round on the bottom edge of molding piece (J), see Fig. 1. (This should be 21⅜″.) Then subtract a total of 1½″ to allow ¾″ on each end. (This ¾″ is for the 3⁄16″ overhang, plus 13⁄16″ for the thickness of the stock used for the side frames, minus ¼″ for the tongue on the edge of the web frame, see Fig. 3.)

The stiles (side pieces) are 11″ long to make the web frame a total of 14″ deep, see Fig. 4. (This 11″ length for the stiles allows for a 10½″ shoulder-to-shoulder distance, plus ½″ for the two ¼″-long stub tenons.)

GROOVES. Next, a ¼″ x ¼″ deep groove is cut along the inside edge of all 16 of these pieces. This groove is for the plywood panel insert, and it also is used to join the web frames.

To join the frames, cut stub tenons on the ends of the stiles to fit the thickness and depth of the groove, see Fig. 5.

PLYWOOD PANELS. Finally, dry-assemble (no glue) the web frames and measure the distance between the bottoms of the grooves to get the dimension of the plywood panels (R). Cut the panels to this size, and then cut rabbets on both the top and bottom faces, leaving tongues to fit in the grooves. Now the rails, stiles and panels can be glued together to form the web frames.

Later, tongues will be cut on the outside edges of these frames to fit into the sides of the cabinet, see Fig. 6.

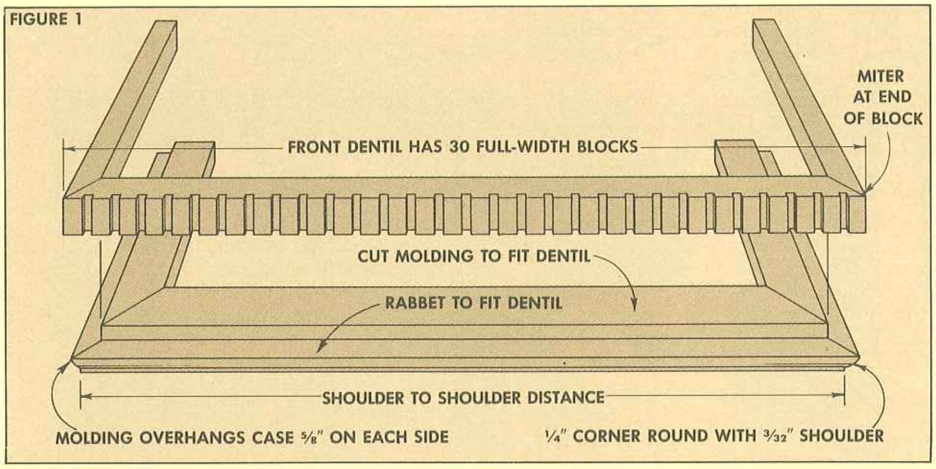
FIGURE 1


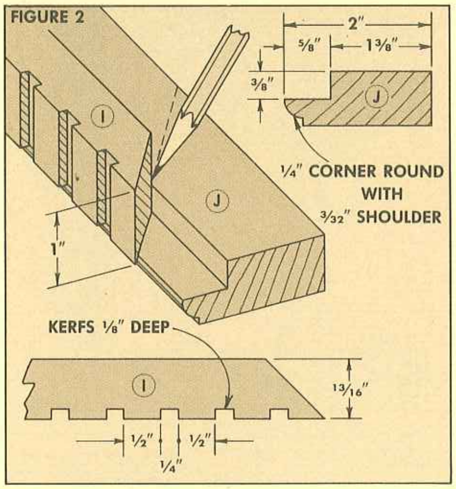
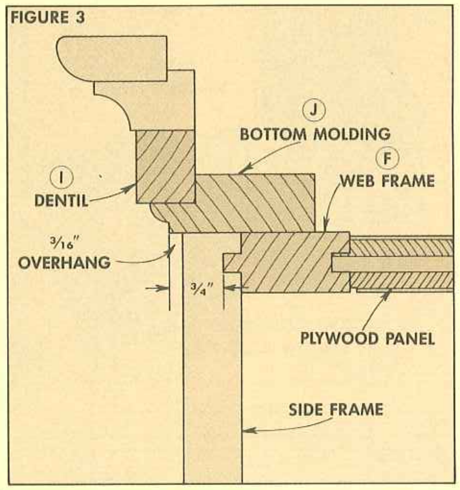
FIGURE 2


FIGURE 3


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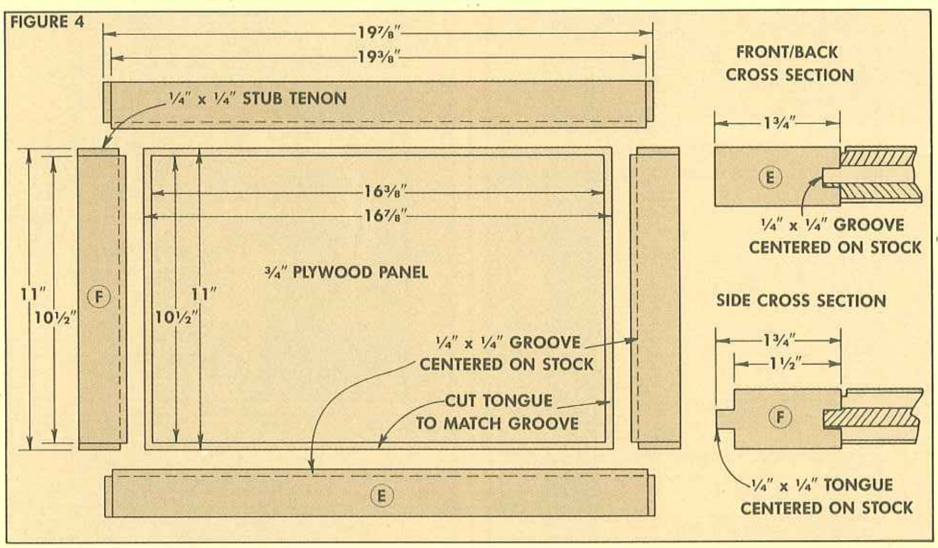

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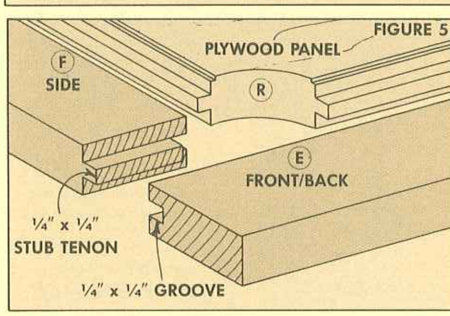

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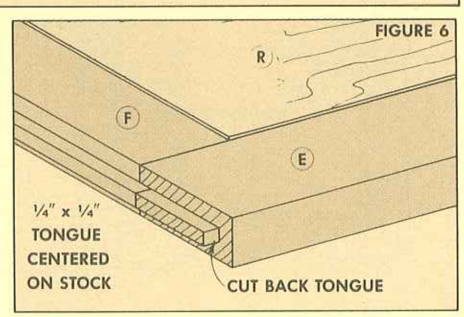


FIGURE 7

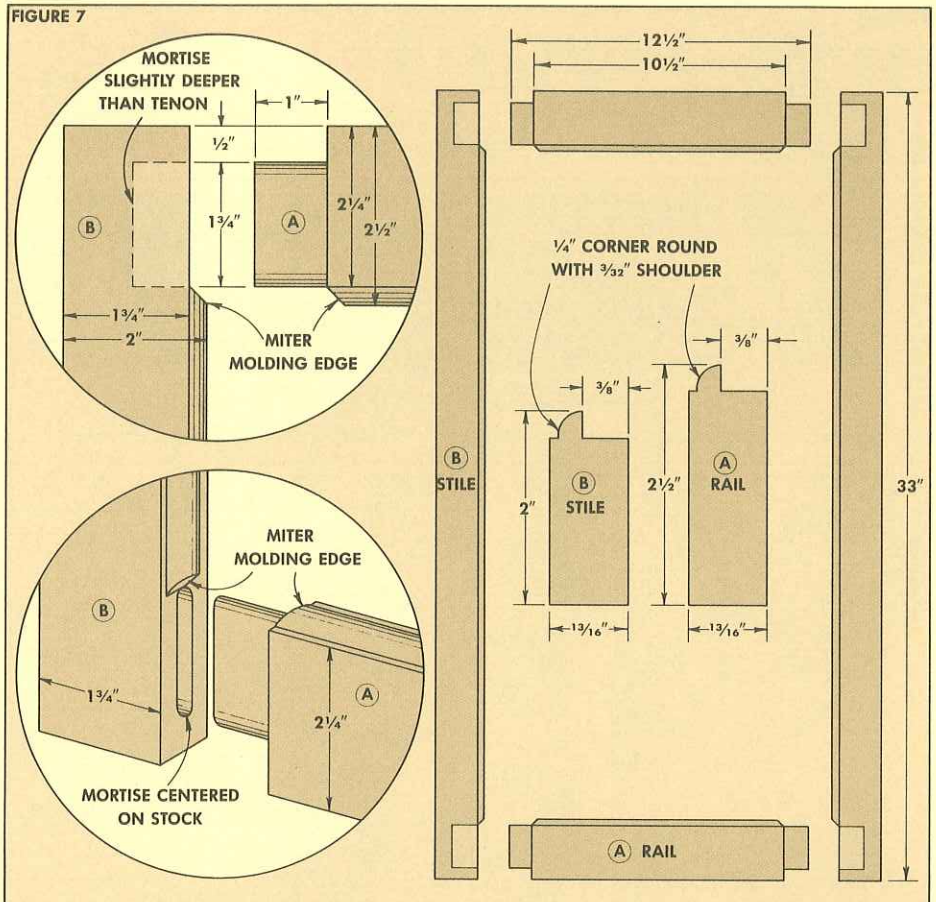


FIGURE 8

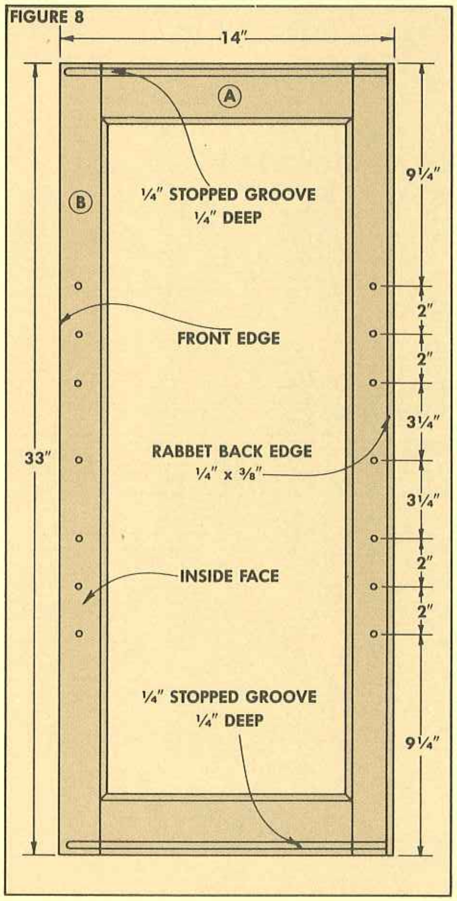


FIGURE 9

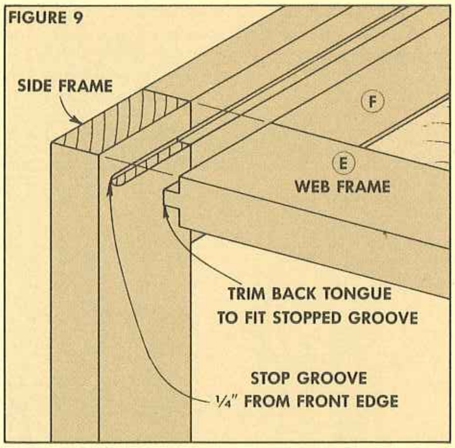
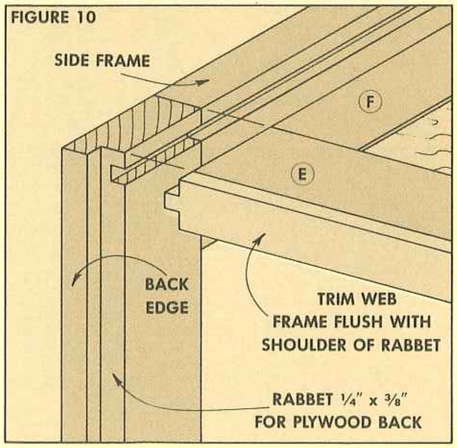


FIGURE 10



THE SIDE FRAMES

The four side frames (two for each unit) are joined with molded-edge mortise and tenon joints. The molded edge on the rails and stiles adds a little touch of class, and also serves as a stop for the glass.

WIDTH AND LENGTH. To build the side frames, rip the stiles (B) 2" wide and 33" long, see Fig. 7. The rails (A) are ripped to a width of 2½" and a length of 12½". (Note: the total width of these frames is equal to the web frames, 14". So the shoulder-to-shoulder length of the rails is 10½". Then add 2" for the two 1"-long tenons to get the final length of 12½".)

MOLDED EDGE. Next, cut a shouldered ¼" corner-round molding on the inside edge of each rail and stile. Set the depth of cut of the router bit to leave a 3/32" shoulder on the face side of each piece, see cross-section in Fig. 7.

RABBET. After the molded edge is routed, cut a rabbet on the back side of this molding so the shoulder of the rabbet lines up with the shoulder of the corner-round. The depth of this rabbet is 3/8" (to accept a piece of single-pane glass and a stop).

MORTISE AND TENON. Finally, the mortises and tenons can be cut. (For details on cutting a molded-edge mortise and tenon see *Woodsmith* No. 24.)

ASSEMBLE AND RABBET. After the joints are cut, assemble the four frames. Then cut a ¼" x 3/8" rabbet along the back edge (on the stile) of each assembled frame to accept the plywood back, see Fig. 10.

Option: I used ¼" walnut-veneer plywood for the backs of this cabinet. However, another option is to use a mirror. In this case, cut the rabbet to the thickness of the mirror, plus enough for a backing piece (poster board), plus another ⅛" for the push points (used to hold the mirror and backing in place).

HOLES FOR SHELVES. Later, two plate glass shelves are mounted in each unit. These shelves are supported with L-shaped shelf pins mounted in ¼" holes.

It's important that these holes are in exactly the same position on all four stiles of each unit. I made a simple drilling jig to align them. Just mark and drill the holes on a piece of scrap, spacing them as shown in Fig. 8. Then use this jig to drill the holes in all eight stiles.

ADDING THE WEB FRAMES

Now the side frames and web frames can be joined together to make the two basic units of the cabinet.

ROUT GROOVES. To join the frames, use a router to cut ¼"-wide grooves on the inside faces of the side frames. These grooves are ¼" from the top and bottom edge of the frame, and stop ¼" from the front edge, see Fig. 9.

CUT TONGUES. Then cut two rabbets on

the edges of the web frames to form tongues to fit in the grooves. This may take some experimenting to make sure the top face of the web frame lines up with the top edge of side frame, see Fig. 9.

TRIM WEB FRAMES. After the tongue and groove joints are cut, the back edge of the web frames needs to be trimmed down a bit so it's in line with the shoulder of the rabbet on the back edge of the side frames, see Fig. 10.

Option: If a mirror is used instead of plywood, rabbet the inside edges of the web frames to match the rabbets on the side frames.

ASSEMBLY. Finally, dry-assemble the web frames and side frames to get the dimensions for the plywood backs, and cut the backs to size. Then glue and clamp the frames together to form the two units. (Tack the plywood back in place to hold everything square while the glue dries.)

THE DOOR FRAMES

Next, the frames for the doors can be built. These frames are sized to allow a ¼" overlap on all four edges.

STILES AND RAILS. First, rip the stiles and rails to a width of 2". The length of the stiles is equal to the opening in the assembled cabinet, plus ½" (to allow for a ¼" overlap on the top and the bottom).

To figure the length of the rails, measure the width of the opening in the cabinet. (This should be 19⅜".) Then add ½" for the overlap (to get the total width of the door frame). Subtract 3½" for the two 1¾"-wide stiles to get the shoulder-to-shoulder length of the rails. And finally, add 2" for the two 1"-long tenons, see Fig. 11.

From here on the procedure for the door frames is just like the side frames: cut the shouldered corner-round on the inside edge, then cut a rabbet for the glass, and finally cut the mortise and tenon joints.

RABBET. When the doors are assembled they should be a total of ½" wider and higher than the opening in the cabinet. Then cut a ⅜" x ⅜" rabbet on the outside edge of the frame to form the lip, see Fig. 14. (Note: The rabbet is ⅜" wide to allow for the ¼" overlap, plus a ⅛" clearance between the rabbet and the frame.)

CORNER ROUND. Finally, cut a shouldered corner-round above the rabbet, see Fig. 15. This matches the cuts on the inside edges, and makes a nice lip around the outside of the door.

DOOR HINGES. The doors are mounted to the cabinet with ⅜"-offset hinges. Normally these hinges are mounted without cutting hinge mortises. However, this creates a small gap on the side of the cabinet. To eliminate this gap, I decided to cut a mortise on the side frame to accept the inside flap of the hinge, see Fig. 16. The other flap is mounted directly to the door (no mortise is needed here), see Fig. 17.

FIGURE 11

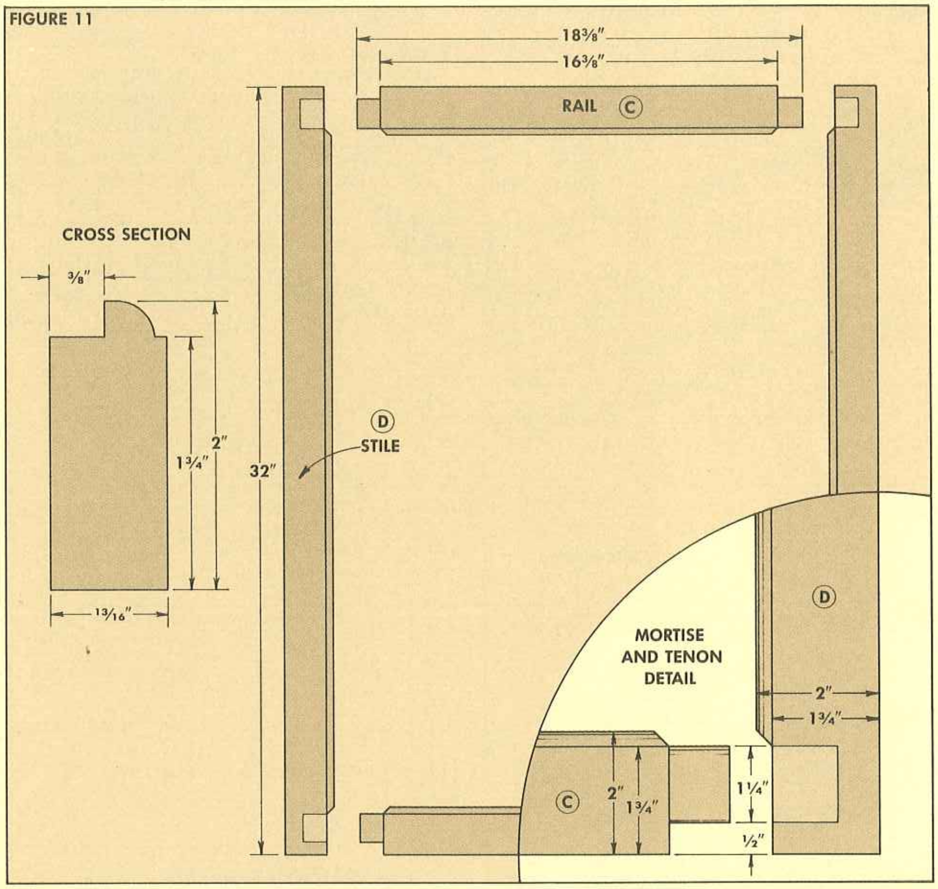


FIGURE 12

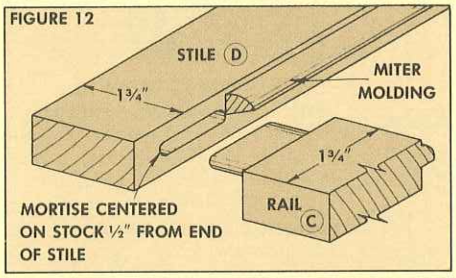


FIGURE 13

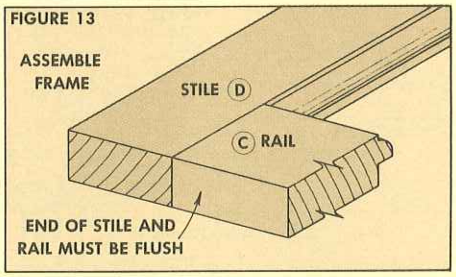


FIGURE 14

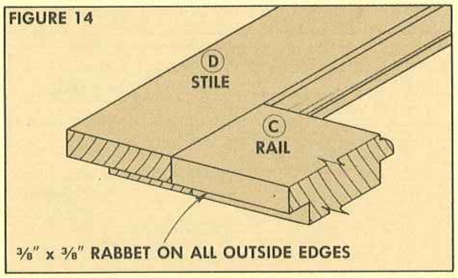


FIGURE 15

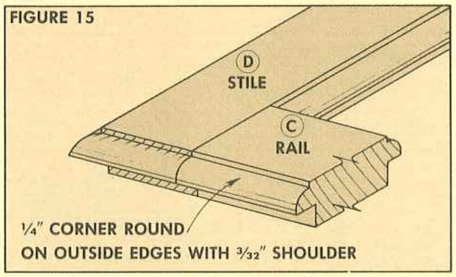


FIGURE 16

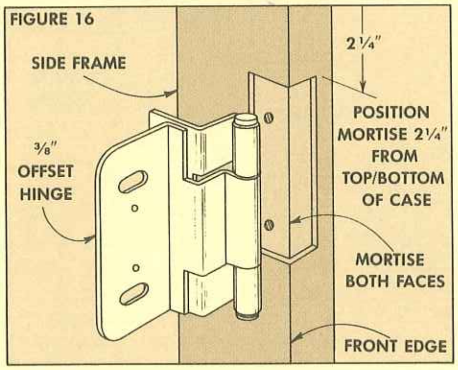


FIGURE 17

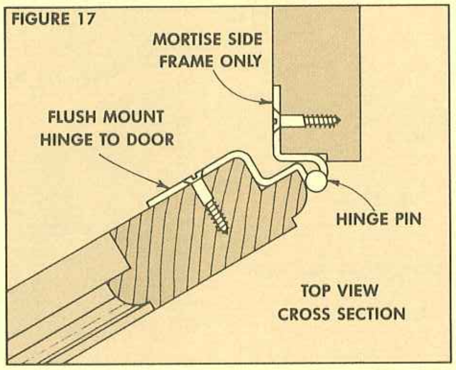


FIGURE 18

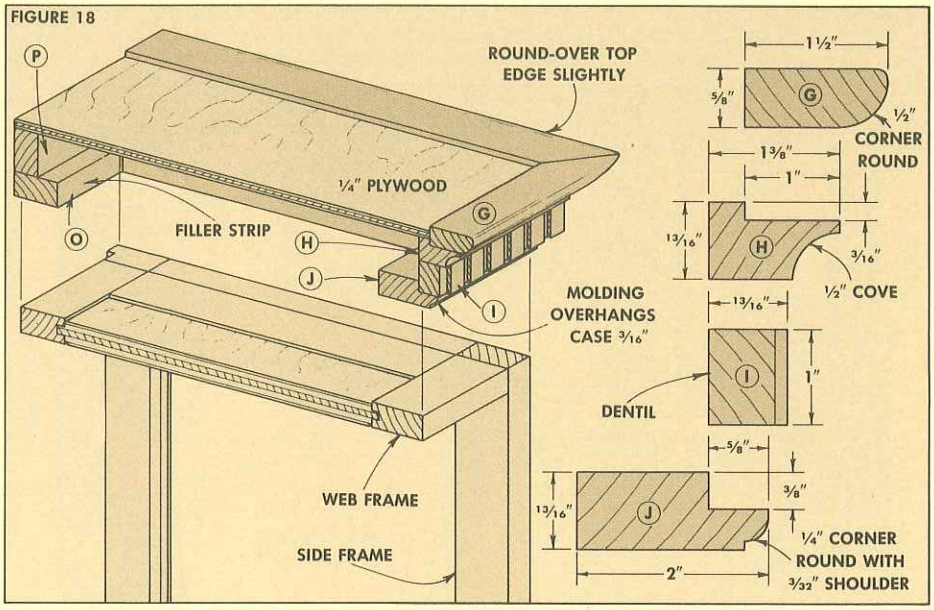


FIGURE 19

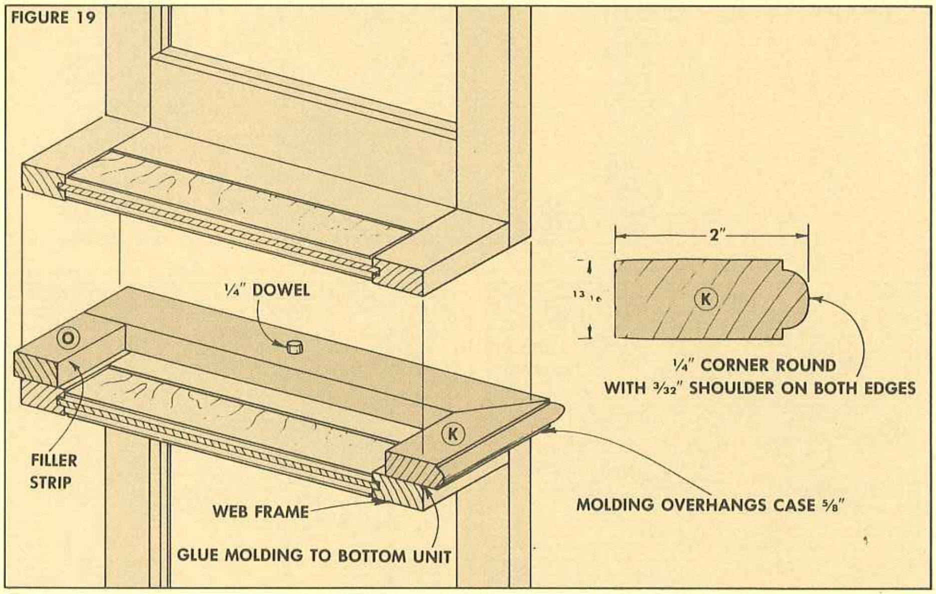
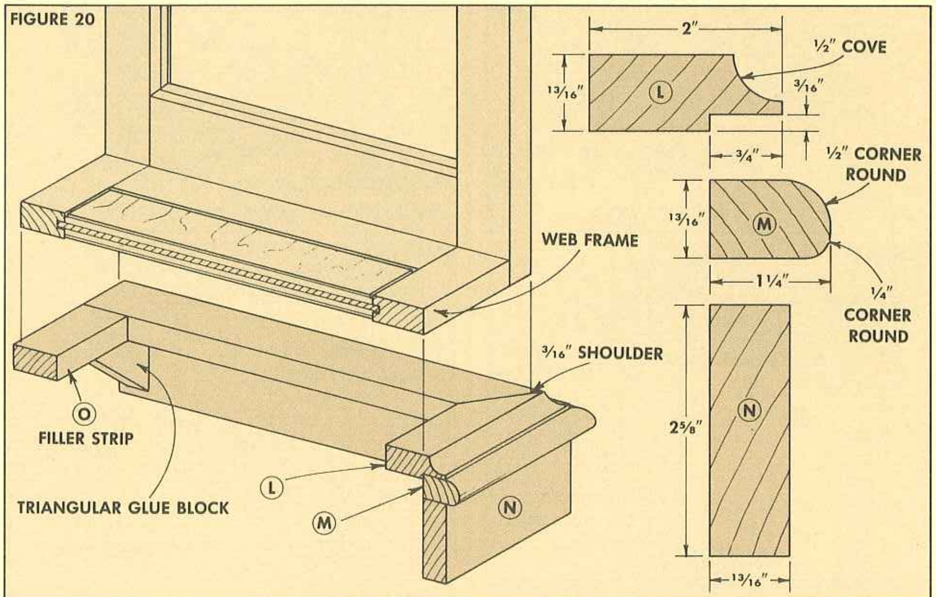


FIGURE 20



THE MOLDINGS

At this point the two basic units for the cabinet are built. All that remains are the molding pieces that make the cabinet shine. I cut all of these moldings on a router table using only three standard bits: a ¼" corner-round bit, a ½" corner-round bit, and a ½" cove bit.

When routing the profiles for these moldings, it's best to sneak up on the depth of cut. That is, don't try to cut the final profile in one pass. Instead, make several passes, raising the bit each time until you reach the full depth of cut.

MOLDINGS AT THE TOP

There are four different molding strips at the top of this cabinet. Two of these were made at the beginning of this project: the dentil (I), and molding strip (J).

MOLDING STRIP (J). I started by gluing and clamping molding strip (J) to the front edge of the cabinet. This front strip was already mitered to length so the shoulders of the corner-round overhang the side frames by 3/16" on each end. The two strips for the sides were cut to rough length. Now they can be trimmed to final length so they're flush with the back edge of the cabinet, see Fig. 21.

THE DENTIL (I). Next, the front dentil strip is glued in the rabbets of molding strip (J). Then the side dentil strips are cut to length and glued in place.

MOLDING STRIP (H). To make the third molding strip (H), rip a piece of stock to a rough width of 1½". Then cut a 1"-wide by 3/16"-deep rabbet on the top edge of this piece, and a ½" cove right below the rabbet, see Fig. 18.

Then rip this piece to final width so the back edge is flush with the back of the dentil, and the front edge (at the bottom of the cove) overhangs the dentil 1/16".

MOLDING STRIP (G). The molding strip (G) at the very top of the cabinet is made by resawing (ripping on edge) a piece of stock to a thickness of 5/8". Then one edge is rounded with a ½" corner-round bit, and the top edge is rounded slightly by sanding. Then this strip is glued and clamped in the rabbet of molding strip (H).

DUST BOARD. To finish off the top of the cabinet, I added two filler strips (O and P) along the back of the cabinet, see Fig. 21. Then I cut a ¼" plywood dust board and tacked it in place.

MOLDING BETWEEN THE UNITS

At this point, the top unit is complete. Next, I added a single molding strip (K) to top of the bottom unit. This strip is made by cutting a shouldered ¼" corner-round on both edges of the stock, see Fig. 19.

The piece for the front of the cabinet is cut to length so the shoulder of the corner round overhangs the front and sides of the

cabinet ⅜". Then the two side pieces are added, and a filler strip is cut for the back.

POSITIONING DOWEL. Since the two units are not permanently joined together (so they can be moved easily), I added a small dowel pin to position them. Drill a ¼" hole centered on the bottom edge of each side frame of the top unit, see Fig. 19.

Then mark the position of a second hole on molding strip (K). When this second hole is drilled, make sure the top unit is positioned on molding strip (K) just like the bottom unit is.

BOTTOM MOLDINGS AND KICK BOARD

There are two molding strips and a kick board at the bottom of this cabinet.

MOLDING STRIP (L). Molding strip (L) is made by cutting a ¾"-wide by ³⁄₁₆"-deep rabbet on the edge of a piece of stock, see Fig. 20. Then a ½" cove cut is made above the rabbet. Glue and clamp this strip to the cabinet so there's a ³⁄₁₆" flat space between the web frame and the cove. Then add these molding strips to the sides, and cut another filler strip to fit along the back edge of the cabinet, see Fig. 19.

MOLDING STRIP (M). Molding strip (M) is ripped to width so it's ½" longer than the rabbet in strip (L). Then the top edge of this strip is rounded with a ½" corner-round bit, and the bottom edge is rounded with a ¼" corner-round bit.

KICK BOARD. Finally, the kick board is cut to size and glued and clamped to the bottom side of molding strip (M). To hold the kick board steady, I glued and screwed triangular glue blocks on the back corners, see Fig. 22.

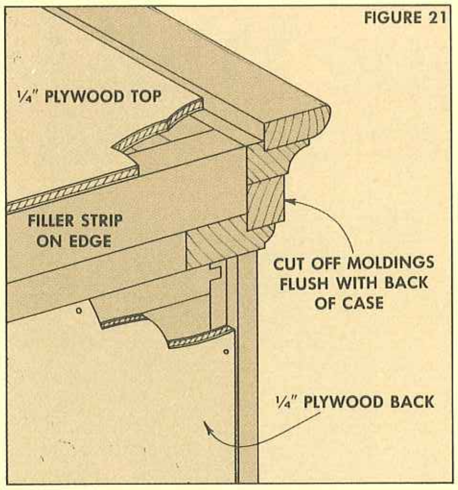
THE FINISHING STEPS

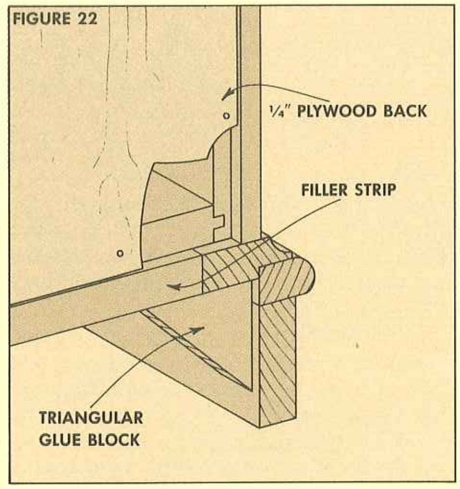
Before any of the glass is installed, I finished this cabinet with three coats of Hope's Tung Oil Varnish. This oil finish has just enough varnish in it to protect the cabinet, but it's also easy to apply and wipe smooth so I didn't have any problems with drip marks on the moldings.

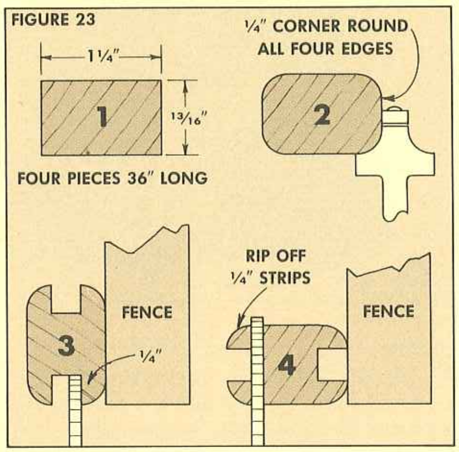
GLASS. Finally, I installed the glass in the sides and doors. (I measured the openings and asked a local glass store to cut single pane glass to fit.) The glass is held in place with custom-made quarter-round stops. (See Figure 23 for the cutting procedure.) To install these stops, I chucked a brad in a drill and predrilled the holes.

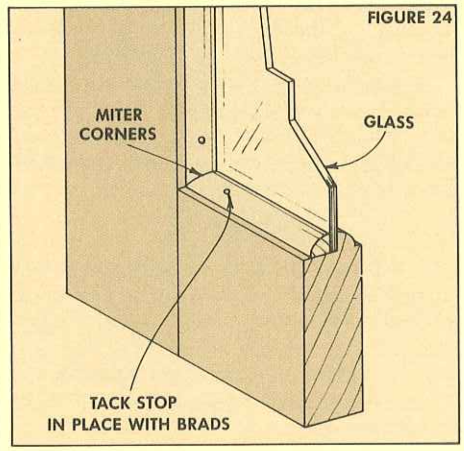
GLASS SHELVES. I also had the four plate glass shelves cut to size (with nicely beveled edges). Note: The width of the shelves should be about ⅛" less than the inside dimensions of the cabinet to allow for the L-shaped shelf supports.

CURIO LIGHTS. Finally, I installed special curio lights, screwing them to the top of each unit. Now it's just a matter of arranging your favorite collectibles (and showing off your favorite cabinet).







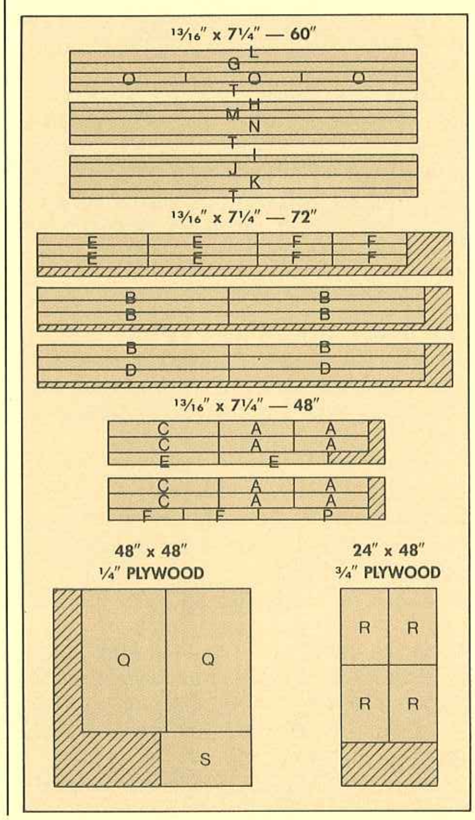


MATERIALS LIST

Overall Dimensions: 73½"Hx21⅜"W—15¾"D	
Side Frames:	
A Rails (8)	¹³⁄₁₆ x 2½ - 12½
B Stiles (8)	¹³⁄₁₆ x 2 - 33
Door Frames:	
C Rails (4)	¹³⁄₁₆ x 2 - 18⅜
D Stiles (4)	¹³⁄₁₆ x 2 - 32
Web Frames:	
E Rails (Frnt/Bk) (8)	¹³⁄₁₆ x 1¾ - 19⅞
F Stiles (Sides) (8)	¹³⁄₁₆ x 1¾ - 11
Top Molding Section:	
G Corner Round	⅝ x 1½ - 60*
H Cove with Shoulder	¹³⁄₁₆ x 1⅜ - 60*
I Dentil	¹³⁄₁₆ x 1 - 60*
J Corner-Round/Rabbet	¹³⁄₁₆ x 2 - 60*
Middle Molding Section:	
K Double Corner-Round	¹³⁄₁₆ x 2 - 60*
Bottom Molding Section:	
L Cove with Shoulder	¹³⁄₁₆ x 2 - 60*
M Double Corner-Round	¹³⁄₁₆ x 1¼ - 60*
N Kick Board	¹³⁄₁₆ x 2⅝ - 60*
Filler Strips:	
O Flat (3)	¹³⁄₁₆ x 1½
P On Edge (1)	¹³⁄₁₆ x 1⁷⁄₁₆
Plywood Panels:	
Q ¼" Backs (2)	¼ x 20¼ - 33
R ¾" Web Frame Panels (4)	¾ x 11 - 16⅞
S ¼" Top Panel (1)	cut to fit
T Glass Stops (16)	¼ x ¼ - 36"

*This length is for three pieces, cut to fit.

CUTTING DIAGRAM



Antique Wall Mirror

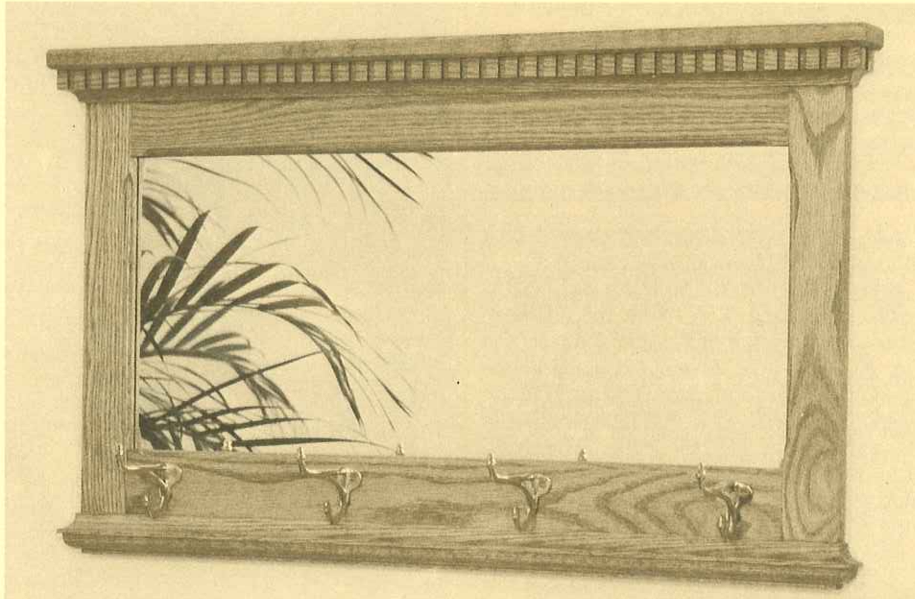
REFLECTIONS ON TIME'S PAST

Things aren't always as they appear. Like mirror images, the looks of this wall mirror/coat rack are a little deceiving. For one thing, it looks like it might be difficult to build. It's not.

For another, my natural inclination would be to build the mirror's frame and then add on the decorative molding. But just the opposite is true.

One of the molding strips should be cut *before* the frame is built. This "backwards" approach is necessary to get the proper spacing for the dentil (the strip of evenly spaced blocks at the top of the frame).

When this strip is mounted to the frame, there should be a full-width block at each end. The only way to make sure the end blocks are full width is to cut the dentil first, then build the frame to fit.



THE DENTIL

There are a total of three dentil pieces: one along the top of the frame, and two short pieces at the ends. To cut these pieces I started with a piece of oak 1¼" wide and 40" long. (This piece is longer than needed to allow for some waste when the three pieces are cut.)

Then I used a cutting jig to cut a series of ¼"-wide kerfs, leaving ½"-wide "blocks" to form the dentil, see Fig. 3. (A complete description of this jig is given in "Shop Notes," page 22.)

COVE CUT. After the kerfs were cut, I added a cove cut along the bottom edge of the dentil strip. Place the dentil strip face down on the router table and make progressively deeper cuts with a ½" cove bit until there's a ⅛" shoulder between the cove and the back of the dentil strip, see Fig. 3.

MITERING THE CORNERS. At this point, the dentil can be mitered to length. Ideally, the length of this strip should be 31¼", and have a full ½" block at each end. At least, that's the way it works out on paper.

In reality, it's almost impossible to cut the kerfs and blocks with perfect spacing. So the actual length of the dentil will have to be altered slightly to get a full-width block on each end.

THE FRAME

Once the dentil is cut to final length, the final dimensions of the frame can be established. The height of the frame is optional — I made it 16", and cut the two stiles (vertical pieces) 2" wide by 16" long.

However, the outside width of the frame must equal to the distance between the mitered "heels" on the *backside* of the dentil. To get this length, measure the "heel-to-heel" distance between the miters, and subtract 4" for the two 2"-wide stiles. This gives you the shoulder-to-shoulder measurement for the rails. Then to get the final length of the rails, add 2" for the two 1"-long tenons.

After the rails and stiles are cut to size, I assembled the frame with mortise and tenon joints, see Figs. 1 and 2.

RABBETS FOR MIRROR. After the frame was glued together, I cut a ⅜" x ⅜" rabbet on the back side to accept the mirror. (See Shop Notes, page 22, for a description of the routing technique used to do this.)

MOLDED INSIDE EDGE. Finally, I thought it would be nice to spruce up the inside edge of the frame by routing a shouldered corner-round profile, stopping this molding cut ¾" from each corner, see Figs. 4 and 5.

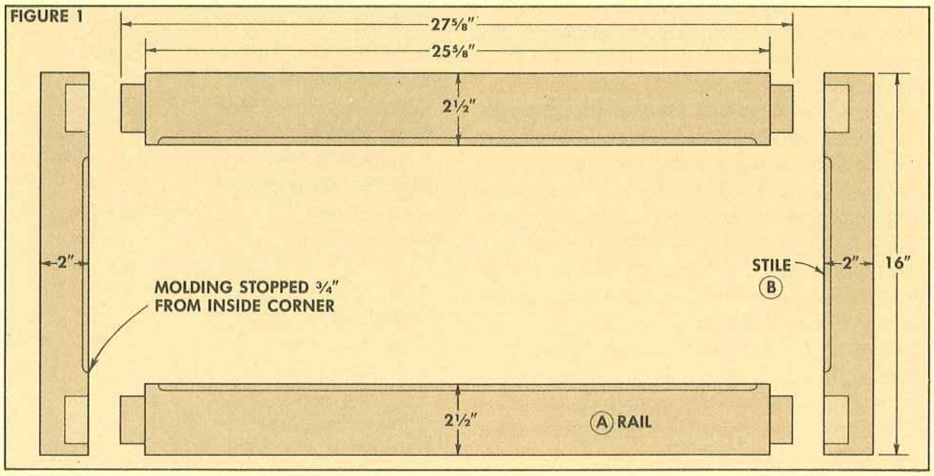
When making these cuts, it's best to sneak up on the depth of cut to prevent excessive chip-out. The final pass should be made so there's a $\frac{3}{32}$" shoulder between the face of the frame and the corner-round, see cross-section views in Figs. 4 and 5.

OTHER MOLDING STRIPS

To complete the frame, I added three more molding pieces: a chamfered cap piece (C) that's mounted above the dentil, and two other molding strips mounted along the bottom edge of the frame (E and F).

THE CAP. The cap piece (C) is just a strip with chamfered edges, see Fig. 4. The length of this piece is a total of ⅜" longer

FIGURE 1



than the dentil (to allow a 3/16" overhang at both ends).

The width of this piece will eventually be 1 13/16" wide to create a 3/16" overhang on the front edge. But in order to have enough width to comfortably rout the chamfer on the ends of this piece, I cut it 2½"wide to start, and then trimmed it to size after the chamfers were routed.

BOTTOM MOLDING. This same procedure is used to cut the two molding pieces for the bottom of the frame. Both pieces start out 3" wide.

Then cut the coved molding strip (E) to length so it equals the total length of the frame, plus 1¼". (This extra amount allows for 5/8" on each end for the ½" cove cut and the 1/8" shoulder, see Fig. 5.) After it's cut to length, rout a ½" cove along the front edge and both ends.

The other strip (F) is cut to length so it's a total of 3/8" *less* than the first one. (This creates a 3/16" shoulder between these two molding strips, see Fig. 5.) Then rout this strip with a ½" corner-round bit, leaving a ¼" shoulder.

After these pieces are routed, they're trimmed to final width: 1 7/16" for the coved piece (E), 1¼" for the shouldered corner-round piece (F).

ATTACHING THE TRIM

After all the trim pieces were finished, I started attaching them to the frame.

To mount the top cap piece and the dentil strip, glue three spacer blocks on top of the frame, see Fig. 6. Then glue and clamp the front dentil strip to the frame so it's even with the top of the spacer blocks.

When that's dry, miter the two corner pieces of dentil to length so they're flush with the back of the frame. And glue them in place.

INSTALL THE CAP. Finally, center the top cap piece (C) on the dentil, keeping it flush with the back of the frame. Glue and clamp it on top of the glue blocks and dentil.

BOTTOM STRIPS. Finally, glue and clamp the two bottom molding strips (E and F) together, centering them on top of each other with their back edges flush. Then glue this assembly to the bottom of the frame, see Fig. 5.

FINISHING TOUCHES

After all the glue was dry on the trim pieces, I sanded the entire frame and stained it with Minwax Natural Pine stain. Then I finished it with two coats of Minwax Antique Oil finish.

I had the mirror cut to size at a local glass company and installed it with a poster board backing and push pins, see Fig. 6. Then I installed the "acorn" coat hooks so they were evenly spaced across the width of the bottom rail. And finally, I used two mirror hangers (see Fig. 6) to hang this mirror frame.

FIGURE 2

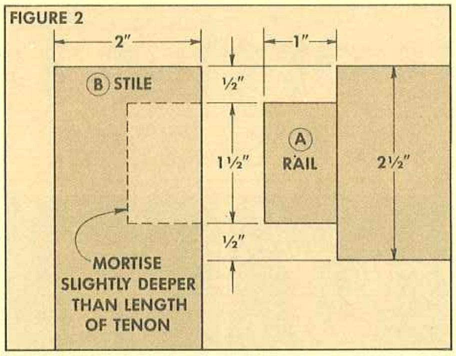


FIGURE 3 DENTIL DETAIL

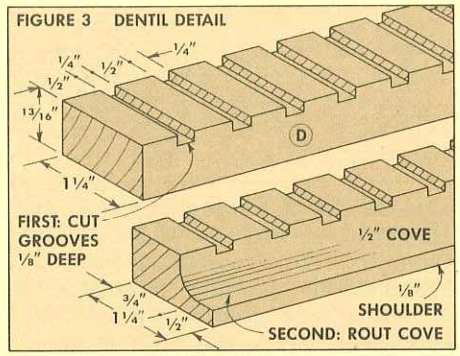


FIGURE 4

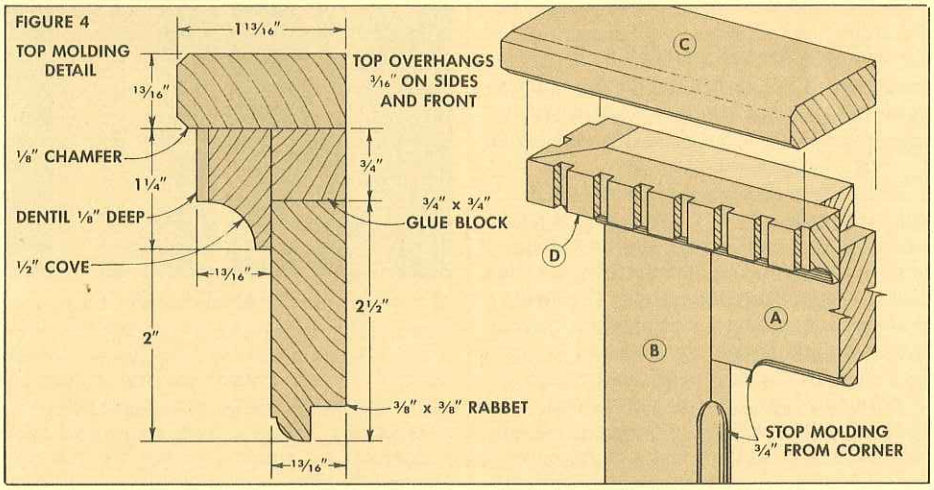


FIGURE 5

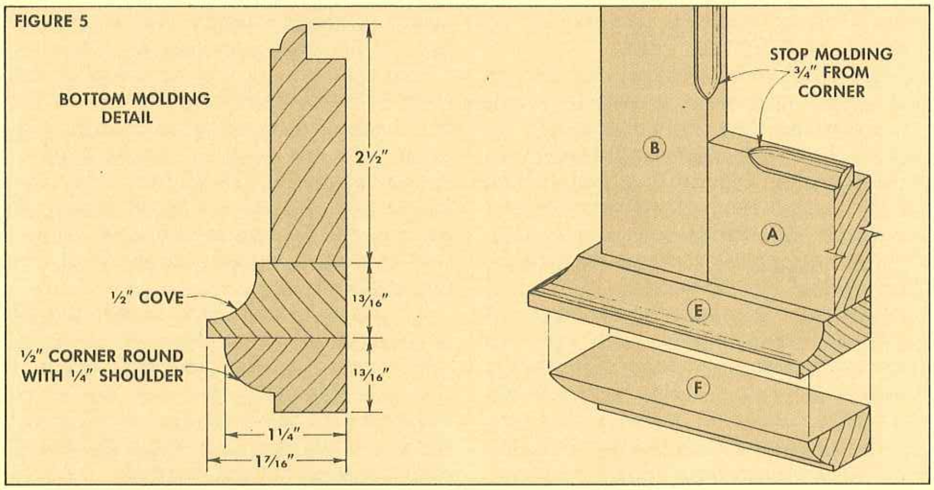
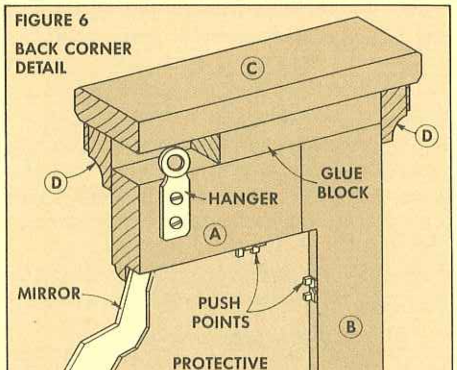


FIGURE 6

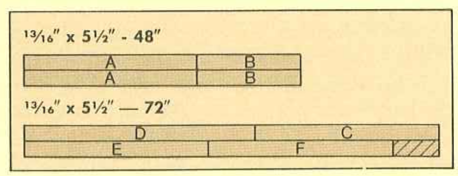


MATERIALS LIST

Overall Dimensions 19"H x 32"W - 1¾"D

A	Rails (2)	13/16 x 2½ - 27 5/8
B	Stiles (2)	13/16 x 2 - 16
C	Top and Btm. Caps	13/16 x 1 13/16 - 31 5/8
D	Dentil	13/16 x 1¼ - 40
E	Cove Molding	13/16 x 1 7/16 - 30 7/8
F	Corner-Round Molding	13/16 x 1¼ - 30½

CUTTING DIAGRAM



Tools of the Trade

MORTISING BITS

Traditionally, mortises were cut by hand. This required using some pretty hefty chisels, and a lot of patience to chop out the square-cornered mortise. Fortunately, there are quicker, and easier methods to produce a mortise.

One of the best alternatives is to machine cut a *slot* mortise (which has rounded corners, rather than square corners). This variation on the traditional style is not only easier to cut, but it's also just as strong. (See page 7 for a detailed description on cutting a slot mortise.)

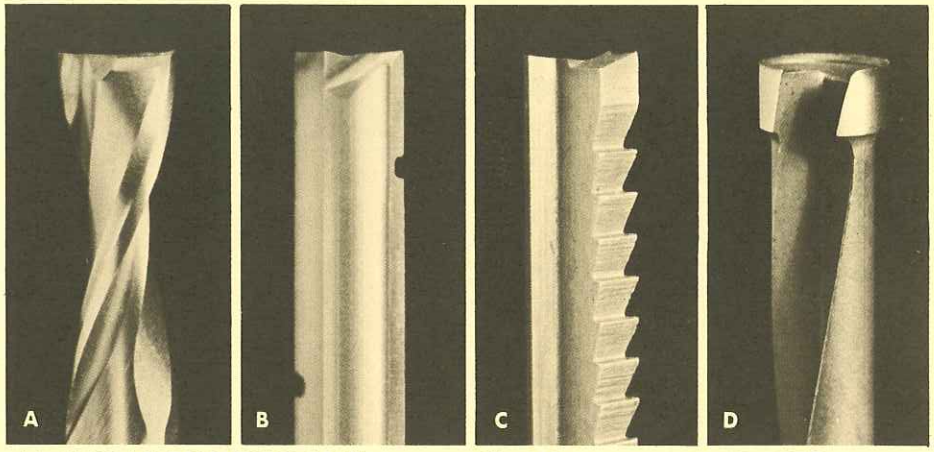
With the multitude of bits on the market, I decided to try drilling a mortise using the two most common bits: twist and brad point bits. Unfortunately, neither one is designed to overcome the unique problems of cutting a slot mortise. And in the end, they usually turn out being nothing more than a source of frustration.

With this in mind, I decided to test five specialty bits specifically designed for cutting mortises. And to make an "apples to apples" comparison between this wide range of bits, I decided to test only the ¼" diameter bit from each group.

I also tried several different methods of cutting the mortises in an effort to find, and overcome, the individual quirks of each bit. Initially I used only the drill press and a fence, and tried cutting the mortises both with, and without, drilling the end holes; and with completely overlapping, slightly overlapping, and non-overlapping holes to clean out the waste.

After trying all of these procedures, if the mortise still wasn't up to par, I tried to improve the setup by adding stop blocks, featherboards, etc. And as each new aid was added, I tried all of the cutting procedures again until I found the combination that produced the cleanest mortise.

Each section listed below includes a description of the bits, and how they're designed to be used. We've also given the results of our shop tests, including the advantages and disadvantages of each bit.



A) SPIRAL END MILL BITS
B) INCA MORTISE DRILLS
C) MORTISE MILLER BITS
D) SEARS MORTISING BITS

SPIRAL END MILL ROUTER BITS

The spiral end mill router bits (A) are heavy duty router bits designed for plunge routing operations. Because they're designed for the limited up and down travel on a router, they have a rather shallow depth of cut (the ¼" diameter bit can only drill a 1"-deep hole).

What really makes these bits special is the fact that they can be used either to rout from side to side, or to make a plunge cut (drill). And because they're router — and not drill — bits, there's no center point to get in the way at the bottom of the mortise.

ROUTERS. When I used these bits in a router, they worked perfectly. (Note: Most end mill bits require a router with at least a ½" chuck capacity. See Sources, on page 24 for more information.)

DRILL PRESS. However, when I used them in the drill press, there were a few drawbacks stemming from the fact that these bits are designed to be used at speeds from 20,000-25,000 RPM. Unfortunately, the fastest speed setting on our Sears drill press is 8500 RPM. And at that setting, it sounds like it's ready for take-off.

At this relatively slow speed, the bit develops a strong tendency to grab the work piece. The best method I found to eliminate this problem was to use both a feather board to secure the piece against the fence, and stop blocks at both ends to limit the length of the mortise.

CONCLUSIONS. Although the spiral end mill bits cut an extremely clean mortise, running the drill press at its fastest speed just plain scares me. And common sense says if I'm operating a machine while scared, the chance of injury increases dramatically. So in the end, I *wouldn't* use the spiral end mill bits on a drill press, even though they can produce a very clean mortise.

However, if a router is used to cut the mortises, these are the only bits I'd use.

THE INCA MORTISE DRILLS

The unique aspect of the Inca mortise drills (B) is that they're designed solely for cutting slot mortises. They're manufactured by the Swiss firm Inca (which is why the bits are measured in millimeters, rather than inches), and are actually only one part of a complete mortising system that's incorporated into the Inca 10" table saw.

Although the mortise drills are designed for use at 3800 RPM of the Inca table saw, they actually look like a router bit (more so than the end mill router bits, which *are* router bits).

The mortise drills have two straight flutes (similar to most straight router bits), and shanks that are slightly larger than the cutting diameter. The only obvious difference is their length (the 10mm bit is over 4½"long), and the obvious nicks in the cutting edge.

"Why in the devil are there nicks in the cutting edge?" That was my first question when I saw these bits. But until I contacted Garrett Wade (which sells a complete line of Inca woodworking tools), I didn't have the foggiest idea what possible purpose they could serve. Garrett Wade informed me that the nicks were actually chip breakers and were indeed intentional, not accidental.

The mortise drills actually perform two operations: drilling and routing. But they're designed to excel when used to *drill* out the waste of a mortise, rather than trying to *rout* it out. Nevertheless, the drills can be used to do a limited amount of routing when making the final cleanup passes on a mortise.

DRILL PRESS. Using the Sears drill press, we couldn't duplicate the speed (3800 RPM) these bits were designed for, so we settled on using the closest setting, 4250 RPM.

At this speed, the bits performed as well as we could have wanted. Our major con-

cern was whether or not the bits would create a lot of chattering, whipping, or walking due to their extreme length.

But the only problems I encountered occured when I drilled overlapping holes, or when I lowered the bit into the wood too quickly. Both these procedures pulled the bit slightly off course. I eliminated both problems by simply drilling non-overlapping holes, and reducing the rate of feed.

Compared to the spiral end mill bits, the Inca mortise drills produced very little grabbing of the workpiece, so stop blocks or feather boards were not required. (But I would still use them anyway.) More severe pulling did occur as the diameter of the bit increased.

CONCLUSIONS. Not only do the Inca mortise drills produce a clean mortise, but they also do it at a reasonable price (the 6mm bit costs $9.00). And these are the only bits capable of producing a very deep mortise (up to 1¾").

PROFESSIONAL MORTISE MILLER BITS

The professional mortise miller bits (C) are also manufactured for use with the Inca 10" table saw mortising system. But unlike the mortise drills, the professional miller bits all have ½" shanks, and their diameters are designated in inches.

The most unusual aspect of these bits is in the way they remove material. The mortise miller bits are designed to remove the waste in a mortise by routing (or milling), rather than drilling (they can drill, but do so reluctantly).

Since the bits are designed for the slow speed of the Inca mortising system (3800 RPM, compared to the 25,000 RPM of many routers), a very unusual edge is used to give them their routing capability.

One of the bit's two cutting edges is serrated. It's this serrated edge that actually hogs off the waste as it's routing. Then the second cutting edge, which resembles the flute on a normal straight router bit, follows through and cleans things up.

DRILL PRESS. Because the mortise miller bits are designed for routing, rather than drilling, they pose some problems when used on the drill press. First of all, the drill press really isn't designed to handle the sideways pressure of routing. If the bit is used for routing on a regular basis, the results usually show up as excessive play in the quill.

To use these bits properly in a drill press, the chuck should be replaced with a routing collet. (See page 23 for more information on Sears routing collet.)

For limited use on the drill press, however, these bits cut a very quick, clean mortise. But as usual, there are some steps that help make the work go smoother.

First of all, I found that the bits produced a cleaner cut if end holes were not drilled. Instead, I routed the mortise by making ⅛" deep passes (starting on the right end of the mortise and routing from one end to the other), and used stop blocks to limit the length of the mortise.

Although I thought these bits would have a tendency to grab the workpiece, in practice the cut is smooth enough that a feather board isn't required to secure the workpiece against the fence.

CONCLUSIONS. Unfortunately, routing with these bits puts too much pressure on the quill of the drill press to create anything but trouble down the road. With this in mind, I can't recommend using these bits for use on a drill press.

SEARS DRILL PRESS MORTISE BITS

In the past, the majority of mortises used for the projects in *Woodsmith* have been cut using the Sears drill press mortise bits (D). One nice aspect of these bits is that they're designed specifically for drilling slot mortises on the drill press.

The cutting edge on these bits is rather unusual. It's located on only the very outside rim of the tip — similar to a Forstner bit. There's also a single flute on the side of the bit to provide room for chip removal.

The Sears mortise bits are extremely easy to use, and require no additional jigs (such as a feather board) to produce a very clean mortise. In fact about the only complaint I have against them is that they're rather slow cutting. (Part of this problem stems from the slow speed — 1000 RPM — recommended for these bits.) If there are several mortises to be cut, this can become a real factor.

The method I found to produce the cleanest mortise was almost exactly the same as used with the Inca mortising bits.

CONCLUSIONS. Not only do the Sears bits produce a very nice mortise, but they're also the least expensive bits we reviewed ($3.49 for the ¼" bit).

SEARS MORTISING CHISEL/BITS

While I was in a testy mood, I decided to check out a system sold by Sears for cutting a traditional square mortise using a drill press. The heart of this system is a unique chisel that has a bit running right through its center. The idea is that the bit removes the majority of the waste, leaving the chisel to "cut" the corners square.

Although this system does what it's designed for (cutting a square end mortise), I couldn't get it to produce a mortise with checks as clean as the other bits reviewed here. And when the price of this system is considered (around $50.00 with all of the extras), I'd prefer cutting a cleaner slot mortise and just pare down the corners.

CONCLUSIONS

The bit we preferred is the Sears mortise bit. It's slow, but it gets the job done. Our second choice is the Inca mortise drills. For cutting a lot of mortises, or especially deep mortises, this is the bit to use.

The professional mortise miller bits are good, but require using the drill press in a manner it's not really designed for (routing). The spiral end mill bits are also good bits, but the noise created while running the drill press at 8500 RPM is more than anyone here is willing to put up with. (However, they're the bits to use in a router.) And when it comes to the Sears square mortise chisel/bit, to be honest, no one here could justify its expense.

COMPARISONS FOR ¼" MORTISING BITS

Bits	Recommended Speed	Maximum Depth of Cut	Shank Diameter	Overall Length	Sizes Available	Stop Blocks Required	Feather Boards Required	Price ¼" Bit
Spiral End Mill Bits	25,000 RPM	¾"	½", or ¼"	3⅜"	¼", 5/16", ⅜" ½", ¾"	YES	YES	$9.00
Inca Mortise Drills	3800 RPM	1¾"	6mm (¼")	4"	6mm, 8mm 10mm, 12mm	NO	NO	$9.35
Mortise Miller Bits	3800 RPM	1⅛"	½"	3⅝"	¼", 5/16", ⅜" ½", ⅝"	YES	NO	$18.50
Sears Mortising Bits	1000 RPM	1"	¼"	2"	¼", ⅜", ½"	NO	NO	$3.49
Sears Square Chisel/Bits	6400 RPM	1⅞"	Does Not Apply	6"	¼", ⅜", ½"	YES	YES	$51.97

Shop Notes

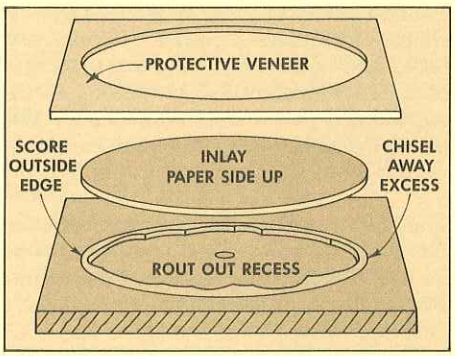
SOME TIPS FROM OUR SHOP

ROUTING A CIRCULAR INLAY

A marquetry inlay is a nice way to add a touch of class to any project. The only problem is getting it mounted. For the Spool Cabinet in this issue, I used a "starburst" inlay, which is a circular shape and is a little easier to work with.

This inlay comes mounted in a rectangular piece of veneer — sort of an inlaid inlay. The first thing to do is remove the inlay itself by gently cutting around its perimeter (with an X-Acto knife), and through the paper backing. (This backing is actually veneer tape that holds all the individual pieces of the pattern together.)

CUTTING THE RECESS. When the inlay is removed, measure its diameter and cut a recess to fit. Because this particular inlay



is close to a true circle, I used an expansion drill to score the outside edge of the recess.

Then I removed the majority of the waste in the recess with a router and a ½" straight bit. Set the depth of cut to approximately three-fourths the thickness of the inlay and rout to within about ⅛" of the score line. To remove the remaining waste (out to the score line), I used a sharp ¼" chisel.

MOUNTING THE INLAY. To mount the inlay, apply a coat of contact cement in the recess and also to the "back" of the inlay. (Note: The side with the brown paper is actually the front, or top side.)

Press the inlay into the recess (with the paper side up) and place a soft-wood block over the inlay and tap it in place with a hammer. Then place a board on top of the inlay to clamp it down (and even it out). Finally, sand the inlay flush with the surface of the board.

ROUTING RABBETS IN A FRAME

Two projects in this issue (the Wall Mirror and the Spool Cabinet) have frames that are built with standard mortise and tenon joinery. Although this simplifies the joinery work, it creates a problem when it comes time to rabbet out the back of the frame (for the glass or mirror).

The easiest way to cut this rabbet is with a router. But router bits have a tendency to chip out the bottom edge of the rabbet, which in this case is the edge that will be seen. Even taking a very light pass doesn't seem to eliminate the problem.

To cut a rabbet with a clean edge, I use a technique that involves lightly scoring the edge of the frame before cutting the rabbet to full width.

THE SCORING PASS. The first step is to secure the frame to a plywood base by tacking stops at all four sides. Then mount a rabbeting bit (that has a pilot) in the router, and set the depth of cut to match the finished depth of the rabbet.

The trick for the scoring pass is to move the router *counter-clockwise* around the inside of the frame. This is the opposite direction of what's normal. (Note: Use the router hand-held. This technique does not work well when the router is mounted to a router table.)

The cut produced with this method is very smooth (there's almost no chip-out). The only problem is that the width of the scoring cut is somewhat difficult to control because the bit wants to bounce off the edge as it's cutting. Try to make it about ⅛" wide.

After the edge is scored, cut the rabbet to full width, but this time rout in the normal direction (clockwise).

CUTTING DENTIL

There are two projects in this issue that use a special molding called a dentil. This is simply a series of ¼"-wide kerfs cut along the length of a solid piece of stock to create evenly spaced ½"-wide blocks.

RIP STOCK TO WIDTH. The first step in making the dentil is to rip the stock to width. I rip it slightly wider than needed so any chip-out on the back side of the kerfs can be removed when the dentil is trimmed to final width.

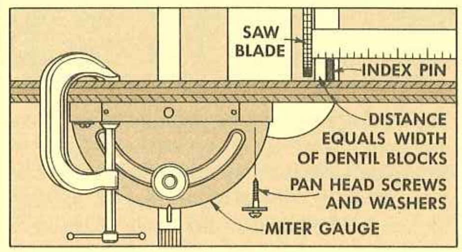
THE CUTTING JIG. Then a cutting jig is made to space the kerfs consistently along the entire length of the dentil. To make this jig, cut a ¾" plywood fence approximately 3" high and about 24" long.

Then cut a notch near the center of the fence for an indexing pin. The width of this notch must equal the width of the kerfs you want for the dentil. (Since I wanted ¼"-wide kerfs, this meant using a dado set to cut a ¼"-wide notch.)

The height of this notch should be a tad under the depth of cut you want for the kerfs. (I wanted the kerfs to be ⅛" deep, so I set the depth of cut for the notch to approximately 3/32".)

Shop Note: The reason for the lower depth of cut for the notch is to reduce the size of the indexing pin that fits in it. This assures that the dentil will rest flat on the surface of the table saw, and not on the top of the pin.

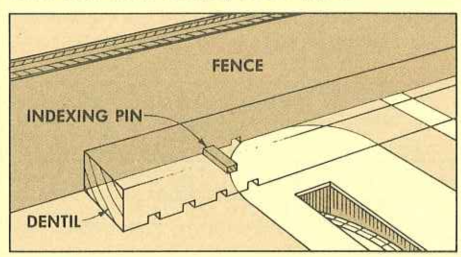
THE PIN. After the notch is cut, cut a 1½"-long indexing pin to exactly the same width and height as the notch, and glue it into the notch.



POSITION THE FENCE. Next, clamp the plywood fence to the miter gauge, and position it so the distance between the indexing pin and the right side of the blade equals the width of the blocks you want for the dentil, see Fig. 1. (I wanted ½"-wide blocks, so I positioned the pin ½" from the blade.)

Check this measurement by nicking the edge of the plywood fence with the dado blade. If the distance between the nick and the pin is correct, drill the pilot holes in the fence and attach it to the miter gauge with pan head screws and washers.

CUT KERFS IN DENTIL. To cut the kerfs in the dentil, raise the dado blade to a ⅛" depth of cut. Then butt the end of the stock against the indexing pin, and make a pass over the dado blade, see Fig. 2.



For the next cut (and all the following cuts), place the newly cut kerf over the indexing pin, and make another pass. This sequence is repeated for the entire length of the dentil.

CLEAN UP. The bottom of the kerfs will probably be a little rough. I used a sharp chisel to "plane" the bottom of each kerf.

Talking Shop

AN OPEN FORUM FOR COMMENTS AND QUESTIONS

FOUR-IN-HAND RASP

I'm having a hard time finding an answer to a question, and I figured if anyone could answer it, you could. Actually, it's rather simple, what is a four-in-hand rasp?

Richard Haas
Clifton, New Jersey

A four-in-hand rasp is a combination rasp and file that has one flat side, and one curved (convex) side. On each side, there are two different tooth arrangements, giving the tool a total of four different cutting surfaces.

On the flat side of the four-in-hand, there's a coarse file on one end, and a coarse rasp on the other. Then on the convex side, it has a fine file on one end and a fine rasp on the other.

Another feature of the four-in-hand rasp is the absence of teeth on its edges. I've found that this is really handy whenever I'm rounding the corners of a tenon. I can nestle the rasp right up next to the shoulder of the tenon without worrying about marring the shoulder of the tenon.

And when you consider the cost (they're usually available from any local hardware store for $10-$15.00), it's well worth having in the shop.

SMALL CHISELS ON WATER STONES

After reading the article in Woodsmith *No. 24 on how good the Japanese water stones were, I ordered the 1200-grit, and the S-1 for sharpening my whittling knives.*

With the 1200-grit stone, there were no problems. I just used it like my conventional stones. First I lubricated it with water, then I placed the blade on the stone with the cutting edge forward, and pushed forward. When the first side had produced a wire edge, I turned the blade over, and pulled it towards myself.

Everything went just fine until I got to the S-1 stone. No matter how gently the blade was pushed over the surface of the S-1, I couldn't help but hack up the surface of the stone. The sharp edge of the blade just kept digging in to the surface.

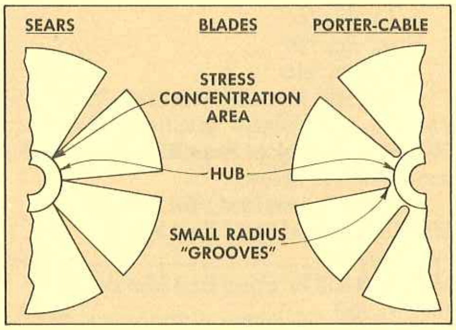
Finally, I found that if I reversed the process and pulled the blade toward me on both sides of the bevel, the problem of the bevel digging into the surface of the stone was eliminated.

Robert E. Drennan
Oxnard, California

CONCENTRATED STRESS

In Woodsmith *No. 24, a reader in your "Talking Shop" section mentioned the trouble he had with his Sears router disintegrating while being used on the* Woodsmith *router table. The same sequence of events happened to me, so I took the router in for repair. After I got it back, it failed similarly after being used intermittently for about one hour.*

As a mechanical engineer specializing in stress analysis, I became very interested in what was causing these failures. When I examined the router closely, I discovered a very poor fan design. The fan is merely a cheap piece of sheet metal roughly cut and stamped into the fan shape. At the root of each fan blade (where they join the hub) is a very sharp corner which creates what is known as a stress concentration (or stress magnifier). This stress concentration will result in premature failure of the fan due to metal fatigue . . . even if it is never struck by foreign objects such as wood chips.



At the high RPM these routers turn, there is a considerable stress level in the fan due to centrifugal and aerodynamic forces. When an object impacts one of these blades, an additional stress is introduced and magnified by the stress concentration. The total stress may then be high enough to result in separation of the blade. When this happens, an imbalance occurs which in turn results in high vibration levels if the router is not shut off quickly. This sequence of events is very destructive to the router to say the least.

A solution could be had by filing a small, half-round groove at the blade/hub intersection, but this is apparently not cost effective for the router manufacturer. I would not recommend this for the average user, since the fan would have to be dynamically balanced afterwards.

When I received my new Porter-Cable (formerly Rockwell) router, the first thing I looked at was the fan. It is of similar design to the Sears fan, but the workmanship is better, and most importantly, it has the previously described grooves near the hub. I have not had any problems with this router, and I have used it considerably.

Even with the improved fan design, I feel that a large enough wood chip (chunk) could cause a similar problem. For this reason, I fasten the hose from my shop vacum near the router base so as to minimize the chip problem.

Jerry Lake
Redondo Beach, California

Sources

DISPLAY CABINET

Woodsmith Project Supplies is now offering the hardware kit needed to complete the Display Cabinet.

Display Cabinet Hardware

W26-726-100 Display Cabinet Hardware Package $16.95

- (1 pair) Solid Brass Ball Tip Hinges, 1¼"W x 1½"L
- (1) Ceramic Knob, 1" dia.
- (1) Circular Inlay, 2¼" dia.

CURIO CABINET

Woodsmith Project Supplies is also offering the hardware needed to complete the Curio Cabinet as shown on page 12.

Curio Cabinet Hardware

W26-726-200 Curio Cabinet Hardware...$27.95

- (2 pr) Semi-Concealed Hinges, ⅜" offset
- (16) Pin Style Shelf Supports
- (2) Cast Knobs, 1¼" dia.

Note: The (2) curio lights come in many styles and should be available from a local lighting fixture retailer, or refer to sources listed below.

CURIO CABINET GLASS. We had a local glass supplier cut single strength glass for the doors and the side panels. The shelves are double strength glass with rounded edges. Although cutting glass is not difficult, I've found that letting someone else take the risks is the way to go. Your local glass supplier will probably be the best one to round the edges of the glass shelves.

ANTIQUE HALL MIRROR

The Hall Mirror uses only one hardware item — four solid brass acorn coat hooks. Listed below are sources for this hardware.

MORTISING BITS

Listed below are the sources for the mortising bits reviewed on page 20-21. (Note: Prices for the bits listed were as of 1994.)

SEARS MORTISING BITS. After reviewing the bits we concluded that the mortise bits sold at Sears were our favorites for drilling slot mortises with a drill press. However, the manufacturer, Vermont American, is no longer producing these bits. A good substitute for these mortising bits are the spiral end mill bits.

SEARS HOLLOW MORTISE CHISEL/BITS. There are three separate parts to the Sears hollow mortising chisel/bit system: the chisel housing, the square chisel, and the bit itself. The chisel housing must be used with the chisel/bits, but luckily, one size fits all. For current prices and additional information contact the Sears nearest you.

- Mortising Chisel Housing

Hollow Mortising Chisels

- ¼" dia. chisel
- ⅜" dia. chisel
- ½" dia. chisel

Mortising Bits

- ¼" dia. bit
- ⅜" dia. bit
- ½" dia. bit

SPIRAL END MILL ROUTER BITS. These bits can be purchased individually from **Woodsmith Project Supplies** or from the sources listed below.

Spiral End Mill Bits

W26-1503-250 ¼" Steel End Mill Bit (¼" Shank)..$19.95
W26-1503-658 ¼" Steel End Mill Bit (½" Shank)..$12.95
W26-1503-664 ⅜" Steel End Mill Bit (½" Shank)..$14.95
W26-1503-667 ½" Steel End Mill Bit (½" Shank)..$15.95
W26-767-275 Set of Three Bits (½" Shank)..$39.95

PROFESSIONAL MORTISE MILLER BITS. Garrett Wade (refer to sources below) is the current supplier for the Mortise Miller Bits.

INCA MORTISE DRILLS. Garrett Wade (refer to sources below) is the supplier for the Inca mortise drills.

ROUTER BITS

We used a number of different router bits while building all three of the projects in this issue. These bits are available from **Woodsmith Project Supplies**. All the bits are carbide-tipped.

Router Bits

W26-1514-625 ¼"-Dia. Straight Bit (¼" Shank)..$10.95
W26-1512-665 ¼"-Dia. Straight Bit (½" Shank)..$12.95
W26-1514-400 ⅜" Rabbeting Bit (¼" Shank)..$24.95
W26-1512-450 ⅜" Rabbeting Bit (½" Shank)..$26.95
W26-1514-814 ¼" Round-Over Bit (¼" Shank)..$23.95
W26-1512-823 ¼" Round-Over Bit (½" Shank)..$24.95
W26-1514-721 ½" Corebox Bit (¼" Shank)..$21.95
W26-1512-730 ½" Corebox Bit (½" Shank)..$25.95

UPDATE. All of the prices and information listed in this issue were current at the time of the original printing. Prices and product availability are subject to change.

WOODSMITH PROJECT SUPPLIES

ORDER BY MAIL

To order by mail, use the form enclosed with a current issue. The order form includes information on handling and shipping charges and sales tax. Send your mail order to:

Woodsmith Project Supplies
P.O. Box 10350
Des Moines, IA 50306

ORDER BY PHONE

For faster service use our Toll Free order line. Phone orders can be placed Monday through Friday, 7:00 AM to 7:00 PM Central Standard Time.

Before calling, have your VISA, MasterCard, or Discover card ready.

800-444-7002

Prices subject to change, call for current prices.

MAIL ORDER SOURCES

Similar hardware and supplies may be found in the following catalogs. Please call each company for a catalog or information.

Woodcraft
800-225-1153
Mortising Bits, Router Bits

Garrett Wade
800-221-2942
Mortising Bits, Router Bits

Woodworker's Supply
800-645-9292
Mortising Bits, Router Bits

Constantine's
800-223-8087
Veneer, Inlay, Router Bits

The Woodworkers' Store
800-279-4441
Veneer, Inlay, Router Bits

The Renovator's Supply
800-659-2211
Brass Acorn Coat Hooks